The FOUNDRY

Volume 52
Number 24

Published
Semimonthly

CLEVELAND, OHIO, DECEMBER 15, 1924

Makes Machine Tool Castings

Large Modern Plant Replaces Old Time Buildings and Equipment Devoted for a Period of Many Years to the Exclusive Manufacture of Power Driven Machine Tools

BY PAT DWYER

ALMOST 60 years ago, which is a long period in a comparatively new country, McKechnie & Bertram, in a modest way, started a small plant in Dundas, Ontario, for the manufacture of machine tools.

The firm which afterward was reorganized under the title John Bertram & Sons has continued in the same line of business ever since. The plant has kept pace with the growing needs of the industry it serves and steadily has adapted itself to the production of more and larger units. Progress over a period of many years culminated recently in filling an order for the Canadian Westinghouse Co., Hamilton, Ont., for the largest boring mill ever set up in Canada and one of the largest on this continent. Total weight of the assembled machine is 325 tons including two 26-ton housings, one 61-ton table, 25 feet in diameter and one 13-ton top brace. The machine is driven by a 60-horsepower motor, is equipped with two boring bars and will handle jobs up to 36 feet 2 inches diameter and 12 feet high. It was designed and built especially for machining the outside frames on large hydroelectric generating sets.

Naturally many interesting features have arisen and been developed in a plant operating continuously over such a long period. One of the most interesting is based on the personnel, which ranges from George Turnbull with 57 years and Sir Alex Bertram with 56 years respectively to their credit, down

FIG. 1—GENERAL VIEW OF THE MAIN BAY OF THE FOUNDRY LOOKING TOWARD THE END WHERE THE CASTINGS ARE CLEANED

FIG. 2—THE MEZZANINE FLOOR SHOWING THE CUPOLAS, ELEVATORS FOR COKE, SAND AND IRON AND THE SAND CONVEYOR BELT

to comparatively new hands who only have been connected with the plant for a trifle of 10 to 20 years. George Manning, general foundry foreman, has been with the firm continuously for 53 years and has held his present position for 31 years. Recently on a day, which by a curious coincidence marked the 53rd and the 31st anniversary respectively of these two events, Sir Alex Bertram, chairman of the board of directors, in the presence of the foundry staff, presented Mr. Manning with a gold watch and appendages suitably inscribed.

Present day writers and speakers who deplore the apparent trend of industry toward an ever-widening gulf between the front office and shop, between the owner of the plant and his workmen, would discover an interesting exception in the relations existing in this highly modern plant in a quiet little Ontario town, nestling almost out of sight in a valley surrounded by a circling chain of hills.

Finished Products

Conditions existing in the plant are reflected in the product. This description is concerned solely with the foundry, therefore no reference will be made to the great machine and erection shops in which the various machines are fitted, assembled and painted and from which later they are shipped. Through long training and familiarity with every local factor entering into the production of machine tool castings, the molders in this foundry have developed the practice of the trade to a high state of perfection. Nearly all the castings are made in green sand molds and yet the skin on the heaviest casting is as smooth and clean as a piece of stove plate and the surface presents no humps or hollows that are not on the pattern. This latter feature particularly is noticeable on the deep vertical sides of lathe and planer beds. The flat, straight surfaces on these castings reflect a degree of skill on the part of the molder that was not acquired in a day or a year. It represents the accumulated experience of many years and is directly traceable to conditions personal and otherwise that prevail in the plant and that have prevailed since its inception.

Sand of excellent quality from a local deposit has been used consistently over a period of many years and this in a large measure accounts for the uniformly satisfactory appearance of the castings. The molders are accustomed to whatever peculiarities the sand possess in the way of susceptibility to dampness, hard ramming and refractoriness and with this knowledge which in time is applied unconciously or instinctively, they apply the water, the vent wire and the rammer in just the exact proportion required to insure a satisfactory product. The sand is secured from a locality within trucking distance of the foundry.

The foundry, although devoted to one line of manufacture, essentially is a jobbing shop on account of the relatively small number of any individual castings ordered at one time. Also because even standard machines almost constantly are being revised and improved and for that reason the patterns are altered more or less from time to time. To maintain its position in the forefront of the industry it serves, the company has a large force of engineers and draftsmen constantly employed in its designing department. In addition to adopting and incorporating changes and improved features in machines already in the field, the engineering force designs new machines for special purposes of which the immense boring mill previously referred to is an example.

Increase Plant Facilities

For some time before the war the manufacturing facilities of the plant were cramped for lack of room and additions of various kinds were in contemplation. The industrial depression immediately preceding declaration of war in Aug., 1914, served to postpone these plans, but they were revived in a more insistent form than ever when England after years of peace once more spread the red ensign to the war breeze and intimated to her loyal sons beyond the seas that she would be glad to have their company in the bickering—their company and their ammunition.

Every machine shop in Canada became a shell factory as fast as it could procure the necessary steel blanks and the machines to turn them into shape. The steel mills rolled the shell blanks at feverish speed and the machine tool builders, including John Bertram & Sons, provided the lathes, planers, milling machines, draw presses and other equipment required to convert the shell

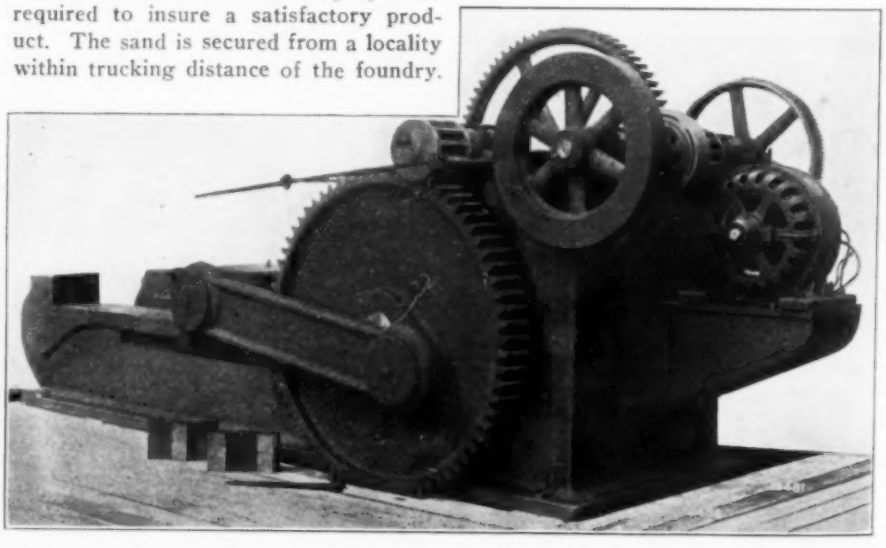


FIG. 3—CASTINGS IN THIS BULLDOZER FRAME ARE FAIRLY TYPICAL OF THE LINE OF CASTINGS USUALLY MADE IN THE FOUNDRY

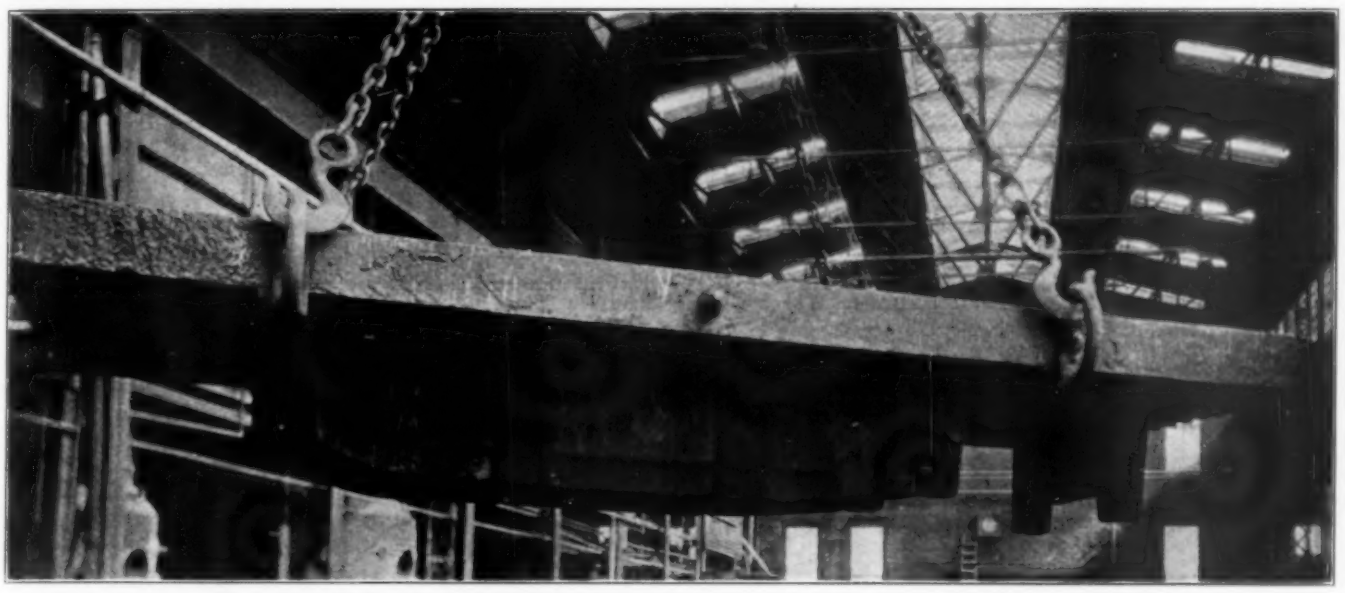


FIG. 4—LIGHTENING CORES REINFORCED WITH SUITABLE CAST IRON ARBORS ARE SUSPENDED FROM THE COPE AND HELD RIGIDLY IN PLACE BY HOOK BOLTS ANCHORED ABOVE THE COPE BARS

blanks into potential engines of destruction on the battlefields of Europe. Under the press of the foregoing conditions it is only natural to find that improvements and extensions to plant and equipment long in contemplation, should be rushed to completion. The old foundry with its low roof and wooden jib cranes was abandoned. A brick and steel building 209 x 116 feet and conforming to the most modern ideas in foundry construction, was erected on a clear space at one end of the group of buildings comprising the entire plant. Ample room is provided for the storage of flasks pig iron and coke outside one end and one side of the building.

A crane runway 500 feet long parallels the building on one side and extends almost 300 feet beyond it at one end. It supports a 20-ton crane made by the Niles-Bement-Pond Co., New York. The yard space under the runway is 70 feet wide and is served by a standard gage switch which with several others, connect the plant with the main line of the Canadian National railroad. Pig iron, scrap, coke and limestone are delivered in cars in this section of the yard and are unloaded by the crane equipped either with a bucket or a magnet depending on the character of the commodity to be handled.

The crane also serves many other purposes. It is used to handle flasks and castings. It is employed to lift the drop ball in reducing large pieces of scrap to a size suitable for placing in the cupola. The greater part of the charge for the cupola is lifted from the yard by the crane and deposited on a platform which forms a continuation of

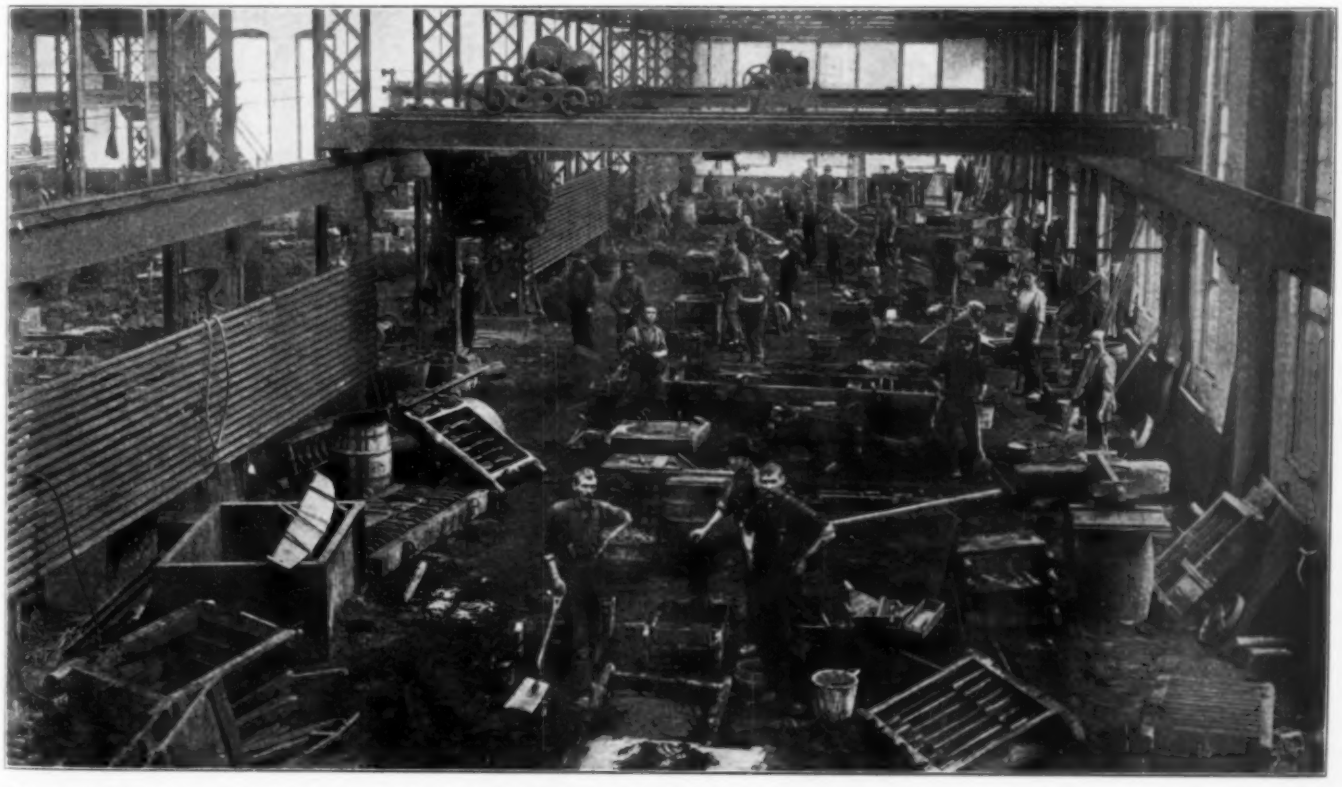


FIG. 5—GENERAL VIEW OF THE SIDE BAY IN WHICH CASTINGS VARYING IN WEIGHT FROM A FEW HUNDRED POUNDS UP TO 2 OR 3 TONS ARE MADE

the charging floor on the outside of the foundry side wall. A suitable doorway provides a means of communication between the platform on the outside and the charging floor inside the building. Coke sand and limestone are lifted on an electrically operated elevator and on occasion some of the iron is lifted in the same manner. A large stock of coke constantly is held in storage on the charging floor and is replenished from time to time as opportunity offers. In this manner dry coke always is available for the cupola. Foundrymen who have heard and read arguments in support of and in opposition to the use of wet coke in the cupola and as a result are doubtful which practice to adopt may be interested to learn that this foundry is lined up on the dry side of the controversy.

The general layout of the foundry follows a fairly universal rule found among general jobbing foundries of medium capacity. The floor is divided into three main bays by the two rows of columns that support the roof and the crane runways. The first bay is divided into three sections, green sand light molding floors at one end, the coremaking department at the other end and the cupola room in the center. The center bay spanned by two traveling cranes, one 25-tons and one 10-tons capacity is devoted almost entirely to the molding of heavy castings in the floor. A space at one end serves as a cleaning room where the castings are chipped and prepared for shipment to the machine shop. The third bay is equipped with two 5-ton traveling cranes and is laid off into a number of floors where medium weight castings from a few hundred pounds up to a few tons in weight are molded and cast. The molds are made in flasks instead of in holes in the floor and usually the molder rolls the drag over instead of bedding the pattern in the sand.

A mezzanine floor extends the complete length of the first bay and forms a continuation of the charging floor. At one end it serves as a store room and at the other end over the core room it is dapted and equipped for storing molding and core sand and for the preparation of facing sand and the mixtures used in making cores. The sand for the various mixtures is passed through a rotary mixer made by the Blystone Mfg. Co., Cambridge Springs, Pa. A belt conveyor takes the sand from the mixing station to the bins in the core room.

Ample drying oven capacity is provided in two large coke fired ovens 18 x 22 x 10 feet and four small shelf ovens fired with gas. The smaller cores are made from an oil sand mixture while the larger cores reinforced with cast iron arbors are made from a mixture of old and new sand bonded with a dry binder. The amount of old sand in the mixture varies according to the severity of the service to which the core is to be subjected. A quantity of coke is rammed in the interior of each bore for the double purpose of cutting down the amount of sand required and to facilitate the passage of steam and gas while the core is in the oven and later while it is in contact with the molten iron.

Constant changes and improvements in the design of machine tools necessitates the construction of a great number of new patterns and the adaptation of old patterns to new uses. Repair parts are required from time to time and as a consequence a large number of patterns must be held in storage. To meet both these features in a proper manner a new patternmaking and storage building was erected at a convenient distance back of the foundry and connected with it by a track on which heavy patterns are conveyed back and forth.

The building was erected according to fireproof specifications and is provided with a monorail system on the two lower floors. The basement is utilized for the storage of the largest and

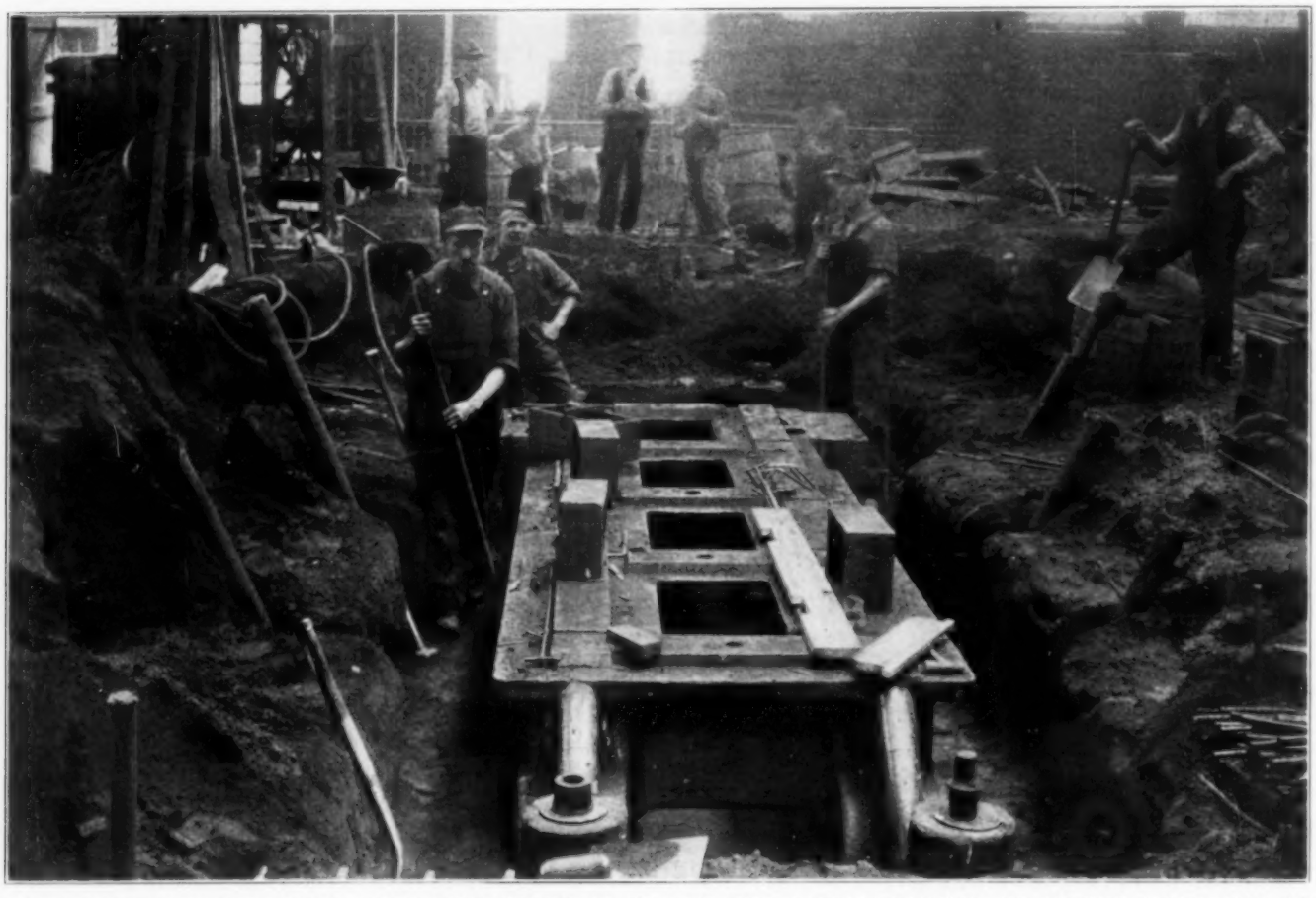


FIG. 6—PATTERN FOR A 10-TON BULLDOZER FRAME AS IT APPEARED PARTLY RAMMED UP IN THE MOLD—THE UPRIGHT RUNNER CORES MAY BE NOTED AT EACH END

heaviest patterns and coreboxes. The ground floor serves as a pattern shop equipped with the necessary benches, layout tables and power driven wood working tools. A motor attached to each tool eliminates all belts and shafting and suitable safety devices conforming to the factory code of the province of Ontario are erected to protect the workmen from accident. The remaining three floors of the building 100 x 100 feet are provided with racks for the storage of small miscellaneous patterns according to a complete card index system by which the location of each pattern is definitely established and by which it may be found by any person at any time. An elevator with the usual safety features and with a cage 10 feet square is employed to convey the patterns to the various floors of the building.

Several steps in the process of molding a 10-ton bull dozer frame are shown in Figs. 4, 6 and 7. The method is typical of that pursued in the production of practically all the larger castings made in this foundry. By referring to the illustrations the outstanding features to be noted are that the entire pattern is bedded in a pit in the floor; the pattern leaves its own cores in the center and the lightening cores in the outer members are made from a dry sand mixture and are suspended from the cope. The complete machine as it appeared on the erection floor is shown in Fig. 3. Outstanding features in the pattern construction are shown in Fig. 6.

A rectangular hole was dug in the floor of a sufficient size to provide approximately 18 inches of space between the pattern and the walls of the pit. The bottom was dug much deeper at one end than at the other to conform to the general shape of the bottom of the pattern. A coke bed 6 inches deep was spread over the bottom of the pit and long vent pipes were erected at each side of the pit as shown in the two illustrations Figs. 6 and 7, to convey the steam and gas from the bottom face of the mold during the pouring process.

A thickness of sand was rammed over the coke bed and then the pattern was lowered into place and blocked up in such a manner that the upper surface was flush with the foundry floor. A level was employed to adjust the upper face of the pattern. This precaution, usually observed for the sake of appearance, in this instance was imperative. The dry sand cores designed to form the chambers inside the casting were suspended from the cope as shown in Fig. 4. Naturally they hung plumb and therefore it is obvious that the face to which they were attached should be level. By leveling the upper face of the pattern it is apparent that the face of the cope which comes in direct contact with the pattern also will be level.

Facing sand was rammed under the pattern and around the lower edges and then the blocks and wedges supporting the pattern were removed and the cavities were packed full of facing sand. Gate cores were adjusted in place at both ends of the pattern close to the bottom. Upright runner cores were placed in such a position that the runner openings coincided with the openings in the horizontal cores. The position of the runner cores at the shallow end of the pattern may be noted in Fig. 6. These cores are prepared in sections and may be built to any desired height. The idea is not original or exclusive, but this clean, smooth, hard dry sand gate is typical of the methods employed for the production of clean solid castings. This style of runner has been in use for many years and is applied to

FIG. 7—THE FINISHED MOLD FOR A BULLDOZER FRAME AS IT APPEARED WHEN THE MOLDERS COMMENCED PLACING THE LIGHTENING CORES—THE CORES RESTED ON TEMPORARY SUPPORTS ON THE BOTTOM OF THE MOLD UNTIL THEY WERE ATTACHED TO THE COPE IN THE MANNER SHOWN IN FIG. 4

nearly all the large molds made in the floor.

Sand was rammed in the deep end of the pit until is approached the level of the remainder of the sand under the shallow part of the pattern. The remaining space in the pit then was rammed full of sand in successive 6-inch courses until it was filled to the top of the pattern. A row of 1-inch rods about 2 feet in length and spaced 4 inches apart was laid down for reinforcement on each successive course of sand.

The large spaces on the interior of the pattern were filled with sand in courses and rammed in a similar manner. The sand also was reinforced with rods laid horizontally and in addition a quantity of coke was incorporated in the center of each body of sand to facilitate the escape of the steam and gas from the body of sand when later it was to be surrounded with molten iron. The coke in each pocket was connected through a suitable opening with the main coke bed under the pattern. The sand under the shoulder was rammed more gently than the remainder of the sand and was vented later with a vent wire inserted from suitable channels cut in that part of the sand which comes into contact with the cope. This feature is clearly illustrated in Fig. 7.

A plain iron cope was rammed over the pattern. Suitable blocks were located at all the necessary points to provide openings for gates, risers, and hook bolts for the cores. The cope was lifted and placed on a pair of blocks where it was allowed to remain until after the cores were lowered into the mold.

All the projecting parts of the pattern were attached temporarily to the main pattern and were released in turn as the sand in the pit was rammed high enough to support them. Thus when the main pattern was drawn out of the sand after the cope had been lifted off, the various loose pieces remained in the walls of the mold.

The face of the mold was not skin dried. It was finished smooth with the tools and then covered with silver lead rubbed on by hand. Experience has shown that this treatment will produce a clean smooth skin on the casting. Pieces of narrow boards corresponding to the thickness of metal in the casting were placed on the bottom face of the mold and the various cores were lowered into the mold until they came to rest on these boards. Narrow guide strips set vertically against the side walls of the mold insured an even thickness of metal on each side of the cores.

After all the cores were set the cope was lowered back into place and long hook bolts were attached to the loops in the cores. Thin wedges were adjusted wherever necessary between the top of the core and the iron bars in the cope. Then the bolts were pulled up tightly to anchor the cores firmly and perpendicularly against the face of the cope. A vent pipe was set in each vent opening in the cores after which the space between the bars over the core prints was rammed full of sand. The runners and risers also were made up and then the cope with the cores suspended was lifted and placed temporarily on a set of high stands where any necessary finishing was done.

After the boards and guide strips were removed from the mold in the floor and after all loose dust had been blown or brushed out, the cope once more was lowered back into place to remain there until after the mold was filled with iron. Long binders secured by bolts at each end were employed to hold the cope in place and to resist the pressure of the molten iron against the submerged cores. The bolts were anchored to permanent binders in the bottom of the pit. The iron was poured from two ladles, one at each end of the mold.

Two cupolas are available in this foundry for melting the iron. One is lined to 46 inches and takes a charge of 2000 pounds of iron; the other is lined to 62 inches and takes a charge of 4000 pounds. The number and weight of the castings to be poured on the floor on any one day determines which cupola shall be used on that day. Air is supplied by a positive pressure blower made by P. H. & F. M. Roots Co., Connersville, Ind., with a capacity of 7000 cubic feet of air per minute at 14 ounces pressure. Canadian pig iron from the Soo and Hamilton, Ont., is used exclusively in the mixtures. It is melted with beehive coke.

Fluorine Reacts Upon Refractories

BY FRANK T. SISCO

IT HAS been observed often by operators of basic electric furnaces that the composition and condition of the deoxidizing slag has some influence upon the condition and life of the furnace refractories, and, conversely, it is well recognized that the condition of the furnace refractories may have a vital influence upon the composition and condition of the slag.

The deoxidizing slag in basic electric furnace practice is made of lime, coke and fluorspar in the ratio of approximately 6:1:1. At the high temperature present in the deoxidation period, the fluorspar is acted upon by oxygen, oxides, carbon, or by heat alone. The fluorine set free reacts with silica in the roof and upper walls to form silicon tetrafluoride. Part of this constituent probably escapes; another part drips into the slag where it reacts with lime to form calcium silico-fluoride. These reactions are going on continuously during the deoxidation period, and are dependent upon the temperature and the amount of fluorspar used.

Fluidity, a most desirable and essential characteristic of the deoxidizing slag is obtained, when fluorspar is used, by the formation of calcium silicates and calcium silico-fluorides, and by the presence of calcium fluoride. When silica sand is subsituted, wholly or in part, for fluorspar the fluidity is obtained mostly by the formation of calcium silicate. With fluorspar, it is possible to maintain a much higher degree of basicity for the same fluidity than is possible with silica sand. This is one advantage of the use of fluorspar. Another advantage is that fluorspar is a direct aid in desulphurizing, while silica sand is not. The third and most important advantage is that it is much easier to maintain strongly reducing conditions, by an excess of calcium carbide, if fluorspar is used. These reducing conditions are necessary to the production of sound, clean steel.

By the proper use of fluorspar, the corrosion of the refractories, while considerable, is not dangerous, and does not shorten refractory life sufficiently to warrant discontinuing the use of this thinning agent.

The use of too much fluorspar, or too high temperature, causes the slag to become thin and watery. In this condition it is smooth and mirror-like and reflects a greater part of the heat from the arcs to the roof and upper side walls, causing them to become overheated and drip. In addition to the reduced life of the refractories, this condition results in a rapid change in the slag composition, destroying reducing constituents, such as calcium carbide.

Refractory life may be shortened by the action of lime dust on the exposed surface of the hot acid brick. Calcium silicate is the result of this action. This constituent melts easily, and thus exposes a fresh surface of the brick to attack. This condition may be almost wholly prevented, or largely minimized by intelligent furnace operation.

Traces History of 121 Years Service

HISTORIC incidents in its "over one hundred and twenty years of service" are presented in a booklet entitled "Pioneering, Engineering and Building" just issued by the Mackintosh-Hemphill Co., Pittsburgh. About half of the 36 pages are devoted to reproductions from newspapers, directories and historical records showing the activities of the company in the early years of the nineteenth century. A chronological record also is presented listing its principal engineering accomplishments.

In an interesting foreword, J. Ramsey Speer, president of the company and great-great-grandson of the founder of the Pittsburgh Foundry which eventually became the Mackintosh-Hemphill Co., traces the trend of engineering development during the span of five generations. He cites the passing of rule-of-thumb methods, the adoption of chemistry and metallurgy in the production of steel and the era of "great individualism" as steps in the transition from the pioneering to the building period.

PITTSBURGH FOUNDRY.

KINGSLAND, LIGHTNER AND CO

MANUFACTURERS OF

CASTINGS OF ALL KINDS,

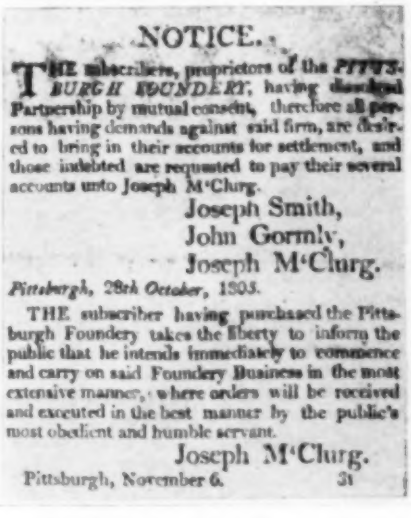
ALWAYS ON HAND

STOVES, SAD IRONS, HOLLOW WARE, GRATES, WAGON BOXES, PLOUGH CASTINGS

&c. &c. &c.

Pittsburgh Foundry and Warehouse, corner of 5th and Smithfield st. Warehouse, No. 78, Liberty st. at the old Jackson Foundry premises.

Fig. 1—Advertisement in Pittsburgh Directory, 1837, of Pittsburgh Foundry founded in 1803 by Joseph McClurg


NOTICE.

THE subscribers, proprietors of the PITTSBURGH FOUNDERY, having dissolved Partnership by mutual consent, therefore all persons having demands against said firm, are desired to bring in their accounts for settlement, and those indebted are requested to pay their several accounts unto Joseph M'Clurg.

Joseph Smith,
John Gormly,
Joseph M'Clurg.

Pittsburgh, 28th October, 1805.

THE subscriber having purchased the Pittsburgh Foundery takes the liberty to inform the public that he intends immediately to commence and carry on said Foundery Business in the most extensive manner, where orders will be received and executed in the best manner by the public's most obedient and humble servant.

Joseph M'Clurg.

Pittsburgh, November 6. 3t

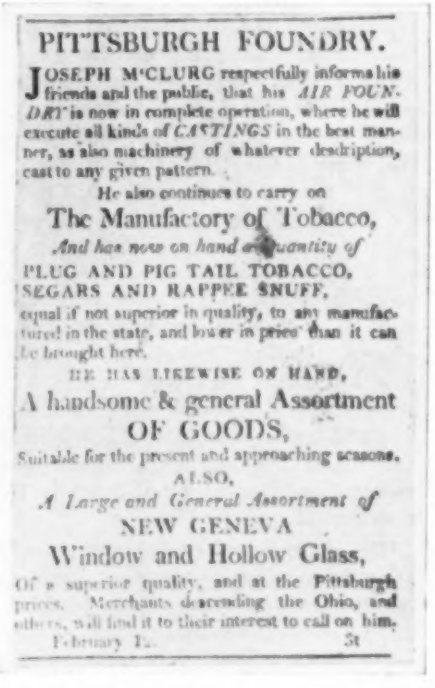
FIG. 2—NOTICE OF DISSOLUTION OF PARTNERSHIP OF PITTSBURGH FOUNDRY PUBLISHED IN THE *COMMONWEALTH*, 1805

Many advertisements, notices and accounts, most of which appeared prior to 1850, are reproduced. These show the changes in management and in firm names that took place from time to time and indicate the nature of the business conducted. Figs. 1, 2 and 3 are reproduced from illustrations appearing on page 6 of the booklet.

The booklet affords numerous sidelights on the activity of the company in furnishing ordnance material. One of the reproductions from a historical record written in 1876 reads as follows:

"In 1803 the first iron foundry was established in Pittsburgh by Joseph McClurg. The Fort Pitt cannon foundry has cast cannon for three wars in which the government of the United States has been involved. A portion of the guns used on the United States ships on Lake Erie at Perry's victory, were cast at this establishment. Guns and shells also were cast for the use of our armies in the Mexican campaign; and during the rebellion in addition to a large amount of guns of the more ordinary caliber, this establishment made the largest guns in the world. Since 1849 there have been 2408 cannon and mortars made in the establishment, of which number 2038 were cast from 1861 to 1864. During the continuation of the civil war, these works were continuously running, with the exception of Sundays, and in addition to the large number of guns turned out, 10,000,000 pounds of shot and shell were manufactured."

Under chronological data is listed the facts that in 1823 the first chilled roll to be made west of the Allegheny mountains was produced; in 1842 the first chilled roll made in this country for rolling sheet brass was produced by the company; and, in 1850 the Fort Pitt works built the first locomotive west of the Alleghenies. During the last 50 years of the company's existence it has built 294 engines, including 84 reversing mill units; and 666 rolling mills including 64 blooming mills, 41 universal mills, 64 plate mills and 156 nonferrous mills.


PITTSBURGH FOUNDRY.

JOSEPH M'CLURG respectfully informs his friends and the public, that his *AIR FOUNDRY* is now in complete operation, where he will execute all kinds of *CASTINGS* in the best manner, as also machinery of whatever description, cast to any given pattern.

He also continues to carry on

The Manufactory of Tobacco,

And has now on hand a quantity of

PLUG AND PIG TAIL TOBACCO, SEGARS AND RAPPEE SNUFF,

equal if not superior in quality, to any manufactured in the state, and lower in price than it can be brought here.

HE HAS LIKEWISE ON HAND,

A handsome & general Assortment OF GOODS,

Suitable for the present and approaching seasons.

ALSO,

A Large and General Assortment of

NEW GENEVA

Window and Hollow Glass,

Of a superior quality, and at the Pittsburgh prices. Merchants descending the Ohio, and others, will find it to their interest to call on him.

February 15. 3t

FIG. 3—JOSEPH McCLURG, HAVING ACQUIRED PITTSBURGH FOUNDRY, ADVERTISED IT IN CONNECTION WITH HIS OTHER ENTERPRISES IN THE *COMMONWEALTH* IN 1806

Plan Malleable Plant

The Berryhill Malleable Iron Co. recently has been incorporated at Evansville, Ind., with a capital stock of $225,000 to manufacture malleable castings. John H. Berryhill, formerly connected with the Vulcan Plow Co.; Daniel Wertz, Claude Wertz, W. S. Partington of Maley & Wertz Lumber Co., Edward Kiechle of the Southern Stove Works, John W. Boehne Jr., of the Indiana Stove Works, George Riechmann of the Evansville Furniture Co., W. J. Stumps of George L. Mesker & Co. and Walter C. Bieneman of the Imperial Desk Co. are identified with the new company. Walter E. Jewell, president of the Jewell Steel & Malleable Co., operator of plants in Buffalo and San Francisco, is interested in the Berryhill organization. A location for the plant has not been selected, but the new company is expected to erect and equip a modern foundry and plant.

The Milburn Sales Co., distributor for the Alexander Milburn Co., Baltimore, in the Philadelphia territory, has taken charge of sales in New York. E. P. Boyer and D. Keyser will be in charge of the office.

Making Cast Manganese Steel

Rapid Melting and Proper Method of Making Slag and Alloy Additions Play Important Role in Producing Satisfactory Metal —How Steel Is Heat Treated

BY J. M. QUINN

PLANTS making manganese steel follow certain methods in the manufacture and a few points in the procedure will be discussed together with some metallurgical considerations.

A few producers use molten metal from the bessemer converter for the initial charge in a basic electric furnace. When the phosphorus content is higher than desired, it is oxidized by ore additions. The oxidizing slag is removed and a new slag made of lime, fluorspar and coke. After securing the proper metal conditions, the required amount of cold or preheated ferromanganese is added rapidly to the metal in the furnace.

Plants operating an acid electric furnace charge the ordinary run of plain steel scrap and make a heat of low carbon steel. Liquid ferromanganese previously melted in crucibles or by other means is added in the ladle as the steel pours from the furnace. A few of these plants make an occasional heat by adding cold ferromanganese to the metal in the acid electric furnace. Large amounts of the manganese combine with the silica in the slag and in the metal, forming manganese silicate resulting in excessive manganese losses and high final carbons. Results are not uniform with this practice and unless considerable skill is exercised in the subsequent heat treatments, the quality of the product is questionable.

The majority of manufacturers operating basic electric furnaces charge all manganese steel scrap or use part manganese steel and the remainder plain steel scrap. One plant remelting all manganese steel scrap claims to have a manganese loss of less than ½ per cent in the electric furnace, while others admit losses of manganese up to 2 per cent. It is advisable to have the scrap as free from rust and foreign matter as possible and placed in the furnace in a compact mass under the electrodes.

Shortly after the power is put on, burnt lime should be added in such a manner that the scrap will be covered, and in this way help reduce the oxidation of the steel to a minimum. Covering the scrap entirely is not possible in all cases and only sufficient lime should be used for a good workable slag.

Furnace charges should be melted quickly to retain as much manganese as possible. This is the practice which has been followed by the author for a number of years when making steel, especially where valuable alloys are in the initial charge and are easily lost by oxidation during the melting down period. The maximum power input is used after steady arcing is secured, so the metal will be brought to a molten condition in as short a period of time as possible. Fluorspar can be added to thin the slag and a small amount of fine coke will produce a mildly reducing condition during the latter stages of the melting down period. Caution should be used in making coke additions as manganese has a strong affinity for carbon and the carbon pickup will be more than desired if excess coke is present or is added so that it comes in contact with the metal.

Carbon Is Lowered

Manganese ore has been used with more or less success both during the melting down period and also later in the operation. The object of manganese ore is to lower the carbon a few points and retain much of the manganese in the steel. Citations of actual practice show a manganese loss of 8.45 per cent and only 0.11 per cent carbon oxidized from the steel. One firm claims it has adopted manganese ore as standard practice. In one instance the author had experience with manganese ore, with apparently good results as shown in the two accompanying charts. With the proper mixes, excellent manganese steel can be made without ore additions and the final results will be more uniform.

When the scrap is all melted and the slag made slightly reducing by additions of the coke, lime, fluorspar mix, a test is taken for observation and a sample sent to the chemist for carbon and manganese determination. Some plants have such regular practice that the preliminary carbon and manganese are not determined and they add the same amount of ferromanganese heat after heat with excellent final results. Of course, when trouble arises adjustments in the manganese additions are necessary.

After the preliminary carbon and manganese have been determined, the manganese addition is calculated either by the usual method which is tedious or by some short method. One short method worked out by the author is here given, where 80 per cent ferromanganese containing 6 per cent carbon is used. No losses or gains are considered as each plant has its own varying practice.

FORMULA FOR CALCULATING BY USUAL METHOD

$$\text{Pounds of Ferro Alloy to be added} = \frac{(\text{Weight of Metal}) \times (\text{Per cent Metal to be Raised})}{(\text{Per cent Ferro-Alloy Used}) - (\text{Per cent desired in the Final Metal})}$$

When making manganese steel from a heat of low carbon metal, the calculation is quite simple with the following short method which is derived from the above formulas.

Each 176 pounds ferromanganese will raise 1000 pounds of steel to 12.00 per cent manganese and the carbon to 0.90 per cent from zero.

Each 194 pounds ferromanganese will raise 1000 pounds steel to 13.00 per cent manganese and the carbon to 0.97 per cent from zero.

A similar method may be applied where any proportion of manganese steel scrap is melted. The carbon obtained from the ferromanganese in this case must be calculated separately, but this seldom is done as the required amount of ferromanganese always will increase the carbon in the metal usually more than desired.

With 7.00 per cent manganese in metal each 72 pounds ferromanganese will raise 1000 pounds steel to 12.00 per cent manganese.

With 8.00 per cent manganese in metal each 57 pounds ferromanganese will raise 1000 pounds steel to 12.00 per cent manganese.

With 9.00 per cent manganese in metal each 43 pounds ferromanganese will raise 1000 pounds steel to 12.00 per cent manganese.

With 10.00 per cent manganese in metal each 27 pounds ferromanganese will raise 1000 pounds steel to 12.00 per cent manganese.

With 11.00 per cent manganese in metal each 14 pounds ferromanganese

will raise 1000 pounds steel to 12.00 per cent manganese.

Intermediate weights easily are calculated by the usual method which can be applied to all cases. Assuming a 6000-pound metal charge and a preliminary manganese of 8.00 per cent the required 80 per cent ferromanganese necessary to bring metal up to 12.00 per cent manganese would be 6 x 60, or 360 pounds ferromanganese, making the total metal weight 6360 pounds.

In preparation for the ferromanganese addition, the slag is cleared up and the metal temperature increased to compensate for the chilling effect of the ferromanganese. If the metal is hot enough, part of the cold ferromanganese is added directly to the bath. When necessary, the remainder of the ferromanganese is placed in several lots on the hearth just inside the doors for preheating and pushed in as fast as the heat of the bath will permit.

When the ferromanganese is all melted and the slag in a satisfactory condition, tests are taken for metal observation. The chilling properties of manganese steel together with the color of the fracture sometimes are utilized to determine approximately the percentage of manganese in the metal before tapping. When poured into a chill mold, a thin section will act like a heat treated piece of manganese steel. Other furnace men pour a test in a sand mold made of two cores pasted together and poured on end. While still red hot this test is quenched in water and broken. If the bend is good the metal is ready to pour; if not, the metal is refined further. The writer contends that many furnace operators have not the skill for judging quenching temperatures by the eye to secure the best results, as the proper quenching temperature for manganese steel is within a narrow range.

Manganese steel has a melting range of approximately 2300 degrees Fahr. this being considerable under ordinary steel melting temperatures. Tests for temperature are taken by pouring a sample slowly from the test spoon and observing how it leaves the spoon and by noting how long it takes for a spoonful of metal to skin over which may vary from 30 seconds to 150 seconds or more depending on the class of work to be poured. After the steel is of the right composition and correct pouring temperatures secured, it is poured from the furnace into a suitable ladle and from the ladle directly into the molds.

At a plant with which the author was identified some years ago, experiments were made with manganese steel. The details of one electric furnace heat are here recorded. This heat trial is interesting as Figs. 1 and 2 show how the steel and slag are affected by the addition of different commodities. Such a heat would not be considered good practice in every day production. The time of the heat is too long from the slag off period and the addition of manganese ore at the latter part of the refining period does not produce quality metal.

A well known type of electric furnace was used, lined with basic material to

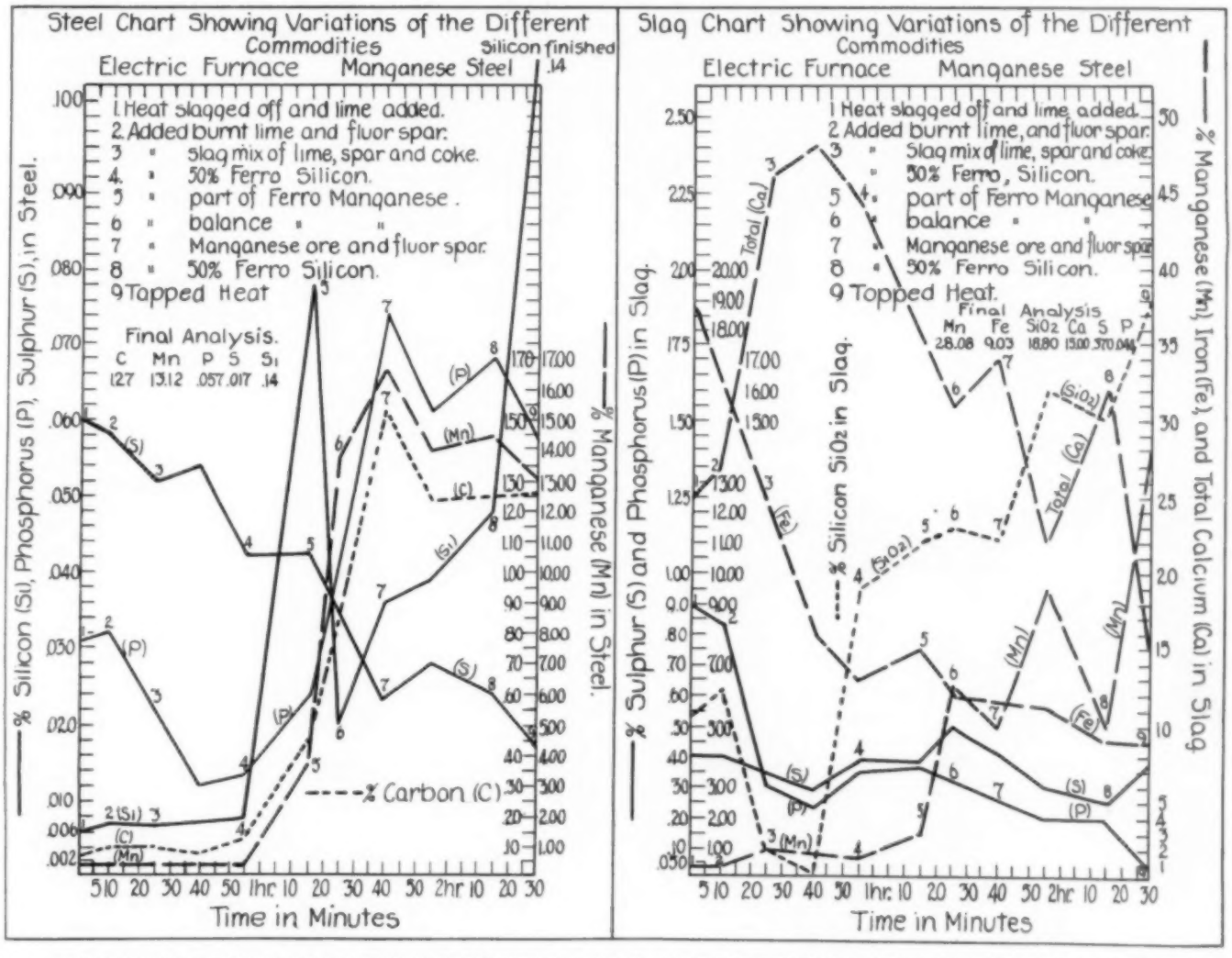

Steel Chart Showing Variations of the Different Commodities
Electric Furnace Manganese Steel
Silicon finished .14
1. Heat slagged off and lime added.
2. Added burnt lime and fluor spar.
3 " Slag mix of lime, spar and coke.
4. " 50% Ferro Silicon.
5 " part of Ferro Manganese.
6 " balance " "
7 " Manganese ore and fluor spar.
8 " 50% Ferro Silicon.
9 Tapped Heat
Final Analysis.
C Mn P S Si
1.27 13.12 .057 .017 .14
% Silicon (Si), Phosphorus (P), Sulphur (S), in Steel.
% Manganese (Mn) in Steel.
% Carbon (C)
Time in Minutes
Slag Chart Showing Variations of the Different Commodities
Electric Furnace Manganese Steel
1. Heat slagged off and lime added.
2. Added burnt lime, and fluor spar.
3 " Slag mix of lime, spar and coke.
4 " 50% Ferro, Silicon.
5 " part of Ferro Manganese
6 " balance " "
7 " Manganese ore and fluor spar.
8 " 50% Ferro Silicon.
9 Topped Heat.
Final Analysis
Mn Fe SiO2 Ca S P
28.08 9.03 18.80 15.00 .570 .044
% Sulphur (S) and Phosphorus (P) in Slag.
% Silicon SiO2 in Slag.
% Manganese (Mn), Iron (Fe), and Total Calcium (Ca) in Slag
Time in Minutes

FIG. 1—VARIATIONS OF ELEMENTS DURING PROGRESS OF AN ELECTRIC FURNACE HEAT OF MANGANESE STEEL. FIG. 2—CHART OF ANALYSES OF SLAG AT PERIODIC STAGES IN MAKING MANGANESE STEEL IN AN ELECTRIC FURNACE

above the slag line with silica brick side walls and roof. Plain steel scrap was charged in the usual manner with an iron ore addition to oxidize the phosphorus to a low point, which procedure is well known to all familiar with electric furnace operation. Starting with the slagging off period, steel and slag samples for analysis were taken every 15 or 20 minutes until the metal was poured from the furnace. The steel and slag charts here given were plotted from these analyses.

Immediately after the heat was slagged off and the burnt lime started to melt in an atmosphere still slightly oxidizing because of the oxidizing slag left in the furnace, pronounced lowering of the sulphur and phosphorus in the steel was noticeable in the steel but much of it quickly passed into the slag. Some silicon in the steel later was obtained from the ferromanganese additions.

The required amount of ferromanganese previously had been weighed, placed in a ladle, and preheated to a cherry red. The greater portion of the manganese was added directly to the steel at one time and only a small amount added later. The carbon and phosphorus contained in the ferromanganese also increased these elements in the steel. After the ferromanganese was all in the furnace, it was found that a mistake had been made in calculating the ferromanganese, which is indicated by the high points in the carbon and manganese curves. As this was an experimental heat, it was decided to add manganese ore to oxidize both carbon and manganese so the steel would be within specification. Apparently excellent results were secured by this manganese ore addition as both the carbon and manganese were lowered considerably. The author does not know of another case in which a manganese ore addition has given such gratifying results.

When the manganese ore reaction was nearly complete, additions were made of the usual coke, lime and fluorspar to produce reducing conditions again. In a short time the final silicon addition was made and the heat poured from the furnace.

Manganese for Castings

While it is generally accepted that making manganese steel in an acid lined furnace from an all manganese steel scrap charge is not good practice, few realize the enormous manganese loss with such a procedure and the erratic results produced.

In a series of experiments conducted by the author on the remelting of manganese steel scrap, some tests were made in a 1000 pound acid electric furnace. Knowing that much of the manganese would be lost, the scrap was melted as quickly as possible, the average time being 40 minutes. Every precaution was taken to retard the reaction of the manganese in the steel with the silica in the slag by the use of burnt lime both during the melting period and the 10 to 15 minutes before the metal was poured from the furnace. The addition of the lime was to neutralize the silica, forming a calcium silicate slag which would leave only a small amount of silica to combine with the manganese in the steel. Not enough lime was used to secure this object. Not attempt was made to adjust the analysis by alloy additions.

Others using the procedure mentioned have secured much better results than is indicated by the following analysis:

Elements	Average Scrap Charge Per cent	Final First Heat Per cent	Final Second Heat Per cent	Final Third Heat Per cent
Carbon	1.25	1.18	1.20	1.15
Manganese ...	12.00	4.55	2.93	2.73
Silicon	0.25	1.02	1.27	1.15
Phosphorus	0.060	0.064	0.072	0.070
Sulphur	0.030	0.026	0.038	0.036

From these experiments it was shown that 75 per cent of the manganese was lost when remelting manganese steel scrap in a furnace lined with almost pure silica. This loss is accounted for easily by the large slag volume resulting from these heats and also by the manganese in the final slag which averaged over 40 per cent manganese. The increased silicon content of the steel to over 1.00 per cent was caused by the reduction of the silica in the slag to silicon which was readily absorbed by the steel.

Records Physical Properties

Physical properties of heat treated manganese steel castings taken from a number of test bars averaged:

Tensile strength—75,000 to 105,000 pounds per square inch.
Elongation in 2 inches—15 to 35 per cent.
Reduction of area—15 to 35 per cent.
Yield Point (approximately)—50,000 pounds per square inch.

Manganese steel as it leaves the molds with ordinary slow cooling consists of manganiferrous austenite and manganiferrous cementite. The cementite imparts brittleness to the steel while the austenite without free cementite is comparatively soft and tough. One authority says with over 12.00 per cent manganese and 0.95 per cent carbon a steel is produced that as cast is entirely austenitic and further states that theoretical explanations of the metallography of manganese steels have not been entirely conclusive.

When water quenching manganese steel, a pure austenitic structure is obtained more easily in the lower carbon than in the higher carbon steels. The piece must not be too large in cross section and it must be heated hot enough and long enough slightly above the quenching temperature so that the cementite will be absorbed in the austenite. While the austenite structure is secured if the quenching temperature is sufficiently high, consideration must be taken that a high temperature produces an enlarged grain and greater quenching stresses which eventually give inferior mechanical properties. Because these considerations apply more forcibly to castings with thick sections than thin sections, a slightly lower carbon content than is the custom of many producers is favored. Using for each steel the minimum quenching temperature to obtain complete austenitization, it is reasonably certain that there would be a gain in impact resistance with a finer grain from the lower quenching temperatures.

Quenching Temperatures

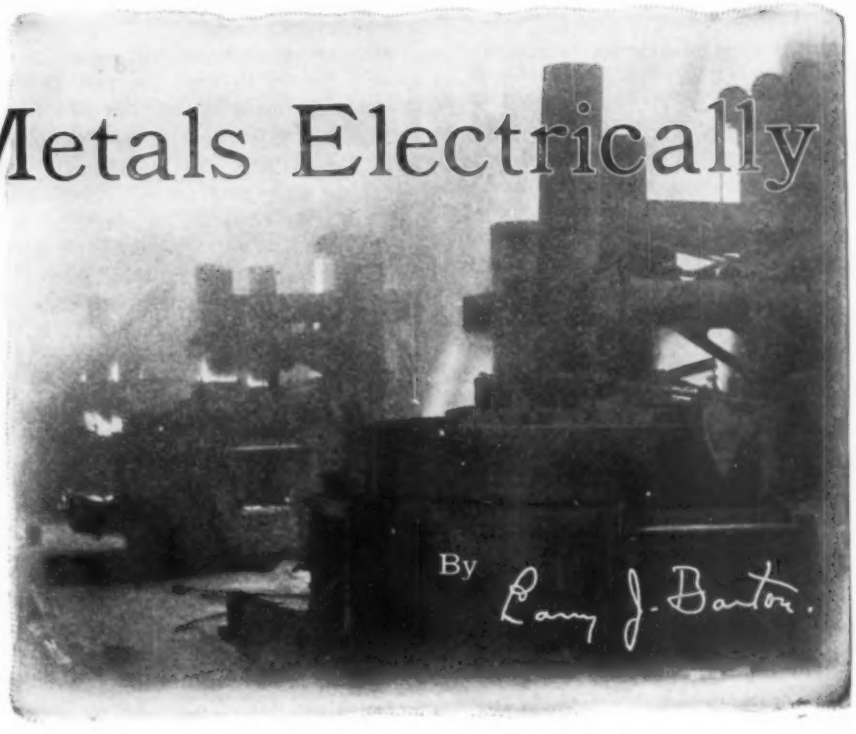
In reviewing the literature on manganese steel there is a wide variance in the figures given as the proper temperature to water quench this steel, even though the steels under consideration are fairly close in analysis. A few of these temperatures are as follows:

Barton .....quench about 1800 degrees Fahr
Diller .....quench about 1832 degrees Fahr
Hall and Hanks quench about 1940 degrees Fahr.
Or about 1470/1560 degrees Fahr. to obtain similar microstructure.
Potter .....quench about 1550 degrees Fahr.
Strauss .....quench about 1650 degrees Fahr.

To secure the best physical properties manganese steel of a definite analysis has a comparatively narrow quenching range and quenching outside that range means loss of ductility or strength and sometimes considerable loss of both. According to W. S. Potter, who gives results of a series of rolled manganese steel bars analyzing 1.10 to 1.15 per cent carbon and 11.00 to 11.50 per cent manganese, he clearly shows that 1550 degrees Fahr. is the proper quenching temperature. Quenching steel of the foregoing analysis 50 degrees Fahr. above or below 1550 degrees Fahr. produces sharp changes in the physical properties and there is a decided decrease in strength when quenched above 1600 degrees Fahr. and in ductility above 1700 degrees Fahr. This series of tests indicates the undesirability of heating to too high a temperature for quenching although temperatures considerably above these are advocated by some manufacturers.

The best known deposits of zircon, the silicate of zirconium, in the United States are in Henderson county, S. C., and in the Wuchita mountains, Okla.

Refining Metals Electrically



Chapter III (Continued)

Analysis Controlled by Slag Manipulation—Causes of Oxidation Noted

ASSUMING that a heat of low carbon steel for castings is being made, the finished metal to analyze approximately as follows: Carbon, 0.22 to 0.26 per cent; manganese, 0.60 to 0.70 per cent; and silicon, 0.25 to 0.30 per cent. A certain analysis of the molten bath will be found to give superior results on finishing. Such an analysis may be considered as a standard and any deviations taken care of during the reducing period. The best analysis of such a bath of steel is about 0.11 to 0.13 per cent, carbon; 0.08 to 0.10 per cent manganese; and 0.05 to 0.07 per cent silicon. A heat of steel composed of scrap analyzing carbon, 0.25, manganese, 0.50 and silicon, 0.15 per cent, and of average character, when melting down to the above analysis will be in excellent condition. There will be enough of the residual alloys to prevent any over oxidization, and yet the steel will be low enough to finish nicely within its limit.

Naturally, if every heat melts down at this analysis, and similar additions of alloys are made, regular results will be obtained. Bringing the molten bath to a certain figure, is without a doubt the secret of regular analyses on the acid hearth. This melt down analysis is not an arbitrary figure, but is that obtained by averaging the melt down analyses of nearly a thousand heats, which were run under what might be considered perfect conditions. The next point is to determine what conditions will influence a change in melting to give either a higher or lower result than desired, and what will be necessary to overcome this difference.

Correcting Low Figures

Low figures on the melt down is shown when taking the first slag and metal test. The metal test is covered with splotches of oxide, and sparks heavily when poured into the chill test mold. As soon as the mold is filled, it generally gases so badly that the steel will be forced up out of the center of the test piece, leaving nothing but a shell. If it does not do this, it will bubble badly while solidifying, and the fractured test will consist of nothing but a net work of steel filled with gas holes, no crystalline structure being present. The slag taken on this test will be a dark black, thin and glassy, being brittle, and is known as a watery slag. Such conditions indicate poor metal, for an over oxidized condition results in a certain amount of oxide being dissolved in the metal. Often it is impossible to remove this oxide and later a cracked casting may result.

This condition is caused by an over supply of oxygen during the melt down which has *burned* out nearly all of the carbon, manganese, and silicon from the metal. This may arise from the following reasons:

This may have been caused by charging a larger amount than usual of small sized, or dirty scrap. This is gross neglect. The melter, himself, should oversee or direct his next heat.

This may be caused by poor fitting doors, or by small pieces of scrap on the sills not permitting the doors to shut down tightly. The best method of overcoming this is to see that each door fits snug before the heat is started. Rake all pieces of metal from the door sills, and if a crack still remains fill it with a small amount of loose sand.

Melting is Delayed

Any delay occurring after the metal has reached a red heat will lengthen the time in which the steel is exposed to oxidation. The result will be a heavy scaling of the metal, the oxide coming either from air entering through the door, or leaking in around the electrodes or through brick cracks in the roof. This delay may be caused by breaking an electrode, the power may go off, there may be trouble with the control apparatus, etc. To prevent any over oxidation, especially when a delay occurs after a pool is formed, a layer of sand should be thrown over the bath, and a light dusting of finely crushed coke added. This will help to cover the metal from any air drafts, the coke offering a protective screen.

In long continued delay, where it may be several hours before the current is again on, sand should not be added or it may solidify and prevent contact being made when the furnace again is started. In such an instance, it is best to give a light dusting with coke alone, the greater part of which will readily burn away without raising the carbon in the bath. In long delays of this

Watch the Slag

IN MAKING carbon steel, the finished metal should possess certain definite analyses, which may be judged as the heat melts down by the appearance of fractured samples and by the appearance and physical aspects of the slag. In this article, the author gives a vivid description of these signs. He warns against the common ills of oxidized metal, and wild heats. He tells how to bring up the carbon and maintain the silicon by proper furnace manipulation and control of the slag. A theory is advanced for the reduction of silicon from acid slags and the author's ideas are supported by a simple experiment which he outlines. In the forthcoming installment, which will conclude the chapter on plain carbon steel, the chemistry of the acid process will be explained in detail.

kind, it is good practice to add ferromanganese figured to about 0.10 per cent, as soon as the current again is on.

To overcome an over oxidized condition, the first step will be to give the entire bath a liberal dusting of coke. This will stop any further oxidation, and immediately will start reducing action on the slag. Ferromanganese may be added in sufficient amount to bring the manganese total in the metal to about 0.20 per cent. Slag now is added to the furnace, and the bath heated. Ordinarily, this treatment will overcome wildness in the steel, and the heat can be finished. However, the metal may have absorbed so much oxide that this treatment will not prove sufficient. This will be determined by the action of the slag. If conditions progress in a satisfactory manner, the slag will turn from a dead black, and water slag, to one dark green in color. The slag will thicken, and lay quiet on the steel. If too much oxide is present, the slag, as soon as the metal heats up, will begin to foam, and will have the appearance of a heavy boil. The only thing to do in such a case is to tilt the furnace, and rake as much as possible of this slag off, and build another.

A high carbon test is evidenced through the metal lying quietly in the spoon, and giving a fairly sound test. The slag ordinarily will be thick, and of a medium green color. The flames from around the electrodes have the soft, luminous appearance of reduction, with a moderate amount of white or light brown vapor. If reducing conditions are severe, the furnace may even snow. Such a condition may be caused in the following ways:

1.—Improper mixture of the charge, allows too great a percentage of high carbon, or shop scrap to the lighter metal. Too much scrap may be used with a large amount of adhering sand, such as ladle sculls or spilled metal, without the addition of ore to cut this reducing agent.

2—A piece of electrode may break off without being noticed, causing reducing conditions to commence.

3—The electrodes may dig causing an excess of slag to be on the metal, and reducing silicon so fast from the silica of this slag that all the oxide is used to again oxidize this silicon.

4—A large amount of slag making material may have been thrown in with the charge, without cognizance being taken of its already high percentage nature. An extra amount of patching material may have been applied to the furnace. This may dislodge and come up to combine with the slag.

Whatever causes such a condition, the result is the same. The composition is too high in carbon and the alloys, and if allowed to continue will result in the silicon being so high in the finished metal as to make it unfit for use.

There is only one remedy for such a condition. Clean the metal rapidly of adhering slag, add ore, and boil until the metal is down to its standard condition, when a new slag may be added and the heat finished. In adding ore to boil the metal, the same care must be used as on basic operation. It is far better to add small amounts than it is to add too much. As this action of ore is endothermic, its action will not take place as soon as added, but will require several minutes until the bath has gained sufficient temperature for the action to proceed. This is an unknown fact to many melters, and after they add, say 50 pounds of ore, there is no immediate action, they come to the conclusion that the ore is held in the slag and make another addition. Then as soon as the ore does start to work they have a pretty boil on their hands, often severe enough to kick the metal and slag out of the furnace door.

May Retain Action

Another point about adding ore is that it may still retain action after its immediate bubbling has ceased, due to the fact that part of the bath may be full of oxide, but too cold to give any action. Now if slag is added this oxide will begin an after boil when heated and the slag will have to be removed. To overcome such occurrences add the ore slowly in small sized portions. Then as soon as the boil begins, do not choke the furnace with ore, but allow each addition to get in its work before adding another. When the carbon is down approximately to its desired percentage, do not add alloys or slag, but allow the metal to heat and poke a rod in the bath to determine if any unmelted lumps remain. If so they must be melted clean before slag is added, if not the metal should be heated for several minutes until any loose portions of oxide or ore have been dissapated, when the heat may be placed under its final slag.

A third point should be considered; that of slag volume. As oxide in high silicon metal tends to form slag in two ways, by combining with the silicon to form silica, and by its corrosive action on the walls, this must be taken into consideration before adding any slag or the final amount may prove to be too much. It must be considered that a highly oxidized slag is thin and watery, and it may look as though there is little slag on the metal. However, when this oxide is eliminated, and the slag begins to thicken, what may have appeared small is likely to prove a considerable amount.

At this particular p[illegible]t certain conditions exist. The metal is low in carbon, manganese, and silicon. It still is cold and due to oxide it is wild. What slag is on the bath is full of oxides of both iron and manganese, which causes the dark color. The steel is in no condition to pour, being of poor quality and too cold. This latter is easy to overcome by continuing the heating, but a steel heated to a high temperature under such oxidizing conditions would be of no use for steel castings as they would give the familiar appearance of a piece of cheese. Therefore, the first step is to eliminate the oxide before the temperature of the steel rises to the point where dissolved oxide will remain in solution. The first step is to add fresh slag in sufficient quantity to perform the desired operation.

For this purpose many materials are in common use. Old floor sand, crushed brick, or almost any form of a silicous materia' will prove satisfactory. This should be rather small in size, preferably of the same character as dry sand, and should be dry and free of any oxide in the form of rust, burned iron, etc. This material is spread carefully over the furnace, the exact amount being dictated by experience. The writer has found about 8 scoops or approximately 150 pounds to be enough for working a 4-ton heat.

After this slag has been in the furnace about 5 minutes the door should be opened and an inspection made. If this slag material has lumped, it must be rabbled, if not the doors can be closed and the metal heated.

At this time the flames issuing from around the electrodes will be rather sharp, and of a reddish blue color, but without any appreciable amount of smoke. However, as soon as this slag is added the flames will drop down to practically nothing, and dense white fumes will be emitted. As this slag melts and diffuses over the steel the white smoke gradually changes to a thin, yellowish white fume, accompanied by the familiar soft, luminous flames denoting the start of the reducing period. This condition also denotes a heating up of the metal, and a test should not be taken.

The metal at this time will be heavily charged witm oxide, and will be rather cold. The slag should be of a dark green in color, and of a medium consistency. If still thin, but green, more slag should be added. If the slag is still black no more slag should be added, but about 10 or 15 pounds of ferro-manganese should be added, and a few small shovels of coke dusted over the slag. Ordinarily this will be sufficient to start the slag to working with its attendant reducing powers.

From this time tests should be taken

with regularity every 4 or 5 minutes, both slag and metal being examined. As the bath heats and deoxidation proceeds this slag gradually will turn into a lighter green finally showing a greenish yellow color. When this color appears the slag should be rather thick and tough, and should string from the test spoon in long streamers when the test issues from the furnace. This is the final and absolute slag test. The metal beginning to heat and the slag is still black, and thin. A metal test taken will be wild, and even may foam up out of the test blocks. Ferromanganese and coke should be added as mentioned, and heating continued. If after heating for several minutes there is no change in its appearance and the metal is still wild, a small amount of additional slag material may be added, and well rabbled in. If this too is unsuccessful, the only procedure is to rake off this slag, and build another, first adding sufficient manganese to the metal to bring its content up to about 0.25 per cent. A dusting of coke is given the slag which will nearly always bring it around.

If there is insufficient slag body on the metal at this point it will be noticed by the slowness of heating, the metal seeming incapable of reaching its proper temperature. The metal tests will show favorable, and the slag will be of a medium green. More slag added quickly will change this condition to its proper state and the heat can be finished.

Slag which is too thick gives a serious condition, especially if occurring while the temperature of the metal is rather low. The slag is thick and heavy, and the arc has difficulty in breaking as can be seen by its irregular actions. The furnace may even begin to *snow*. If this is detected at the start, a slag test should be taken and its condition noted. If the slag merely is lumped or viscous due to a high silica content, a small amount of burned lime added quickly will bring it to proper condition. However, if the slag volume is too large, part of it must be raked off at once. If allowed to continue, the result will be a rapid reduction of silicon into the metal with the chance of having an off heat. The writer has seen silicons analyze as high as 1.00 per cent when finished under such conditions.

It may be possible to have a perfect slag and still have *wild* metal. This may sound peculiar, but is explained by the fact that the slag itself is the main deoxidizer and operates by absorbing the oxide from the metal, bringing it to the surface, where it is removed by combining with carbon. The freed iron or

Types of Metal Tests on the Melt Down

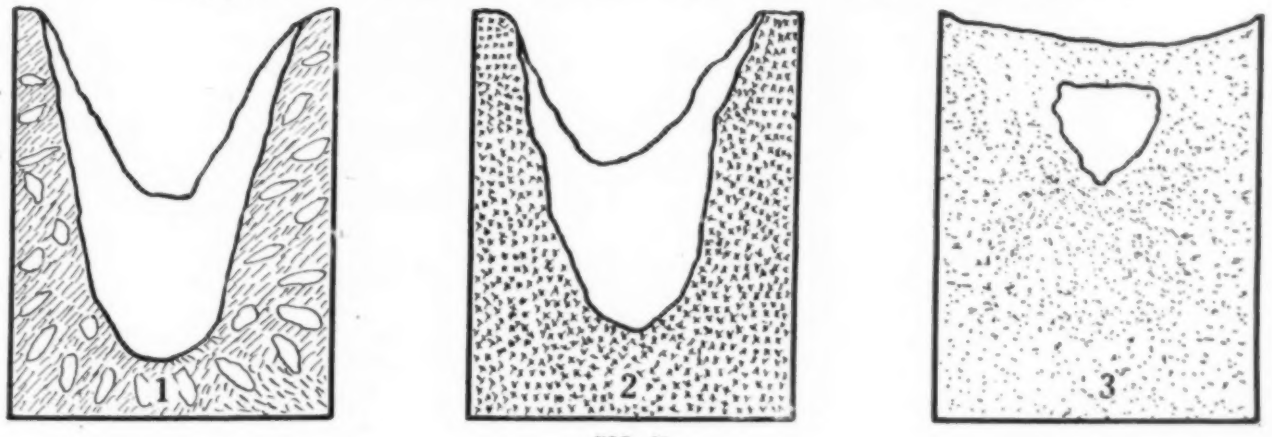


FIG. 29

No. 1—Overoxidized Metal

Carbon, manganese and silicon all under 0.070 per cent. Metal impregnated with oxide as shown by the gas holes. The metal has no apparent crystalline structure, the test having the appearance of tearing, rather than breaking, when fractured. Slag test accompanying such metal will be thin and watery, and of a glassy black color.

No. 2—Metal of Correct Composition

Carbon approximately 0.11 to 0.17 per cent; manganese, 0.08 to 0.20 per cent; silicon, 0.05 to 0.10 per cent. Metal around rim, where chilled, has a sound structure with a distinct crystalline appearance, the crystals being from medium to large in size. This test will bend before breaking, and often may show evidences of tearing. Slag accompanying such metal may be moderately thin, but usually will be a lighter color—a dark gray, or often a dark green. If black the slag will be more of the nature of lava, being rather dull, without much lustre. It will not resemble the brittle, glassy slag of overoxidation, but will be rather tough in character.

No. 3—Metal Coming Down Too High

Carbon, usually above 0.30 per cent; manganese ranging from 0.20 to 0.35; silicon, from 0.15 up, the latter depending largely on the carbon content. Metal will consist entirely of a crystalline structure, the size of the crystals depending upon the carbon content, and the rapidity of quenching. When broken it will snap with little impact from the hammer, often with a sharp snap. The slag on such a test will always be green, the degree of color depending upon the degree of reduction, and the volume of the slag body. The slag structure will depend upon the quantity present, and will range from one with a fair degree of brittleness to that resembling a finishing slag, being very tough and stringy.

at this time should be free from any reddish brown oxide spots on its surface, and should pour over the test spoon in a clear blue stream, with little sparking. The test will not be absolutely sound, but should not contain any apparent blow holes on fracture having clear metal around its run, where it has chilled against the mold.

If the above conditions exist the heat is ready to be brought to its final analysis and poured. However, certain other conditions may exist at this point, and the metal never should be poured under any but perfect conditions.

Often through the metal becoming over oxidized at this point the metal is

manganese in the slag then combines with another charge of oxide and the process is repeated until the metal is clear. The reason for the metal being wild under these conditions is the fact that it has had insufficient time to perform its work on the metal. The solution is to hold the bath under this slag in a similar manner to holding steel under a carbide slag in the basic furnace. Oxide in the metal easily may be determined by observing its surface in the test spoon as taken from the furnace. If oxide is present small reddish brown spots will appear, and disappear on the surface of the metal, the steel sparking when poured. If the bath is free from oxides the metal will have the familiar bluish appearance, its surface being mirror like in its freedom from spots.

The slag being of correct composition, and the metal being in a deoxidized condition, the next step is to bring it to a temperature high enough so that approximately 10 minutes more will be required to heat to pouring temperature. The present analysis of the metal is known, either by experience—or by actual analysis, the latter always being preferable where possible.

As soon as this point is reached, it is time to recarbonize if necessary. If the carbon is correct, the manganese of the percentage desired is added in rather large lumps, being slightly moistened if the slag is thick, and allowed 5 minutes to diffuse thoroughly, when the heat is poured.

There are as many ways to recarbonize a heat of acid steel as of basic, but it must be remembered that time is an important consideration in this process. The steel cannot be held at this high temperature for any length of time without picking up silicon so that the addition of coal, coke, graphite, etc., and rabbling into the steel is unsatisfactory, due to the length of time necessary to perform this operation, and check its effectiveness by tests. Therefore, three main methods of adding the necessary carbon remain, namely; by using pig iron, carburite, or by immersing the electrodes in the bath with the current off.

Carburite is a mixture of iron and carbon containing a high percentage of the latter, and having a high enough specific gravity to sing into the metal. The only objection is the fact that small pieces might be held in the slag and its composition is so high in carbon that a small difference in weight would make a large difference in the metal analysis. For exact practice this eliminates this alloy.

Immersing the electrodes is common practice in many shops, but this shows carelessness. Many variables are encountered such as the size and character of the electrodes, the effective area exposed to the metal, the temperature of the metal, the volume and viscosity of the slag, and the present content of the metal. These make this practice unsafe. When the electrodes are lowered into the metal, they become coated with a varying amount of slag. A melter cannot tell these conditions and the result is that he fools himself into thinking that this constitutes good practice by assuming that carbon added immediately before the pour will not have the chance to lower itself by reducing silicon. With electrodes at 6 or 7 cents a pound this will prove a rather expensive method of adding carbon, especially at the end of a year's time.

The one remaining recarbonizer, pig iron, is the best and cheapest agent for adding the desired carbon. The amount added is exact. The pig is so heavy that it naturally passes the slag and is all absorbed by the metal. It is cheap. These points constitute a great advantage. The main argument advanced against the use of pig is that after its addition the current must be kept on a sufficient length of time to heat it up to the pouring temperature. The objection here arises that under such high temperatures the carbon will tend to reduce the silicon, thus automatically lowering itself. The writer never has found this to be true on heats where the carbon content was under 0.30 per cent. On many heats, where the pig was added at least 20 minutes before the pour, the metal being heated high enough to pour 60 flasks, the carbon drop never amounted to over 0.03 per cent, and on many of these instances the difference might have been due more to error than to furnace conditions.

On extremely high carbon heats, for instance, 0.80 to 0.90 per cent carbon, where this amount of carbon constitutes a great part of the iron impurities this feature of reduction holds, and it is here advisable to use a different method, the best being the use of a higher percentage scrap, so that little carbon adjustment is required.

Silicon Lowered

Often a heat may seem to be coming down perfectly, but as the temperature rises to the finishing point, it will be noticed that much silicon is being reduced. This will manifest itself by the silvery appearance of the metal in the spoon, and by its quick setting when poured into the mold. The metal may be hot, yet will freeze as soon as it leaves the spoon. This often misleads melters, regarding the heat of their metal, and results either in pouring a cold heat, or one so hot that it actually welds with the sand of the molds. If the metal is hot enough to pour, the best thing to do is to tap at once, and change the silicon addition accordingly. The amount of this change can be learned only by experience, but approximations can be given. If the ordinary silicon addition, made to metal where there is no apparent pick up, is 0.20 per cent, this should be cut in half if the metal is held under the above conditions for 5 minutes. If held for 10 minutes no silicon should be added. Another method is to add the manganese and take a test in a sand mold. If the metal sets nicely there will be no silicon required, any additions being based upon the action of the metal in the sand. Under the conditions of extremely hot metal used for small casting work, this pick up will approximate 0.02 per cent per minute, where the refining current is about 120 volts.

If the metal still is too cold to pour, the best remedy is to rake off as much as possible of the slag, and add enough ore to cut this silicon. A small amount of lime will keep the slag fluid for the remainder of the heat without any further danger of such reduction. Ordinarily this reduction will not take place until the metal becomes hot, and then will amount to little if the silica content of the slag is kept below 55 per cent. When this silica content passes 55 there is nothing present to hold the silica in combination, and reduction is the natural action. Often lime added at the first signs of silicon will furnish a base to hold this excess silica in combination without any reduction.

This reduction of silicon occurs only in the presence of heavy slags and is enhanced by the presence of coke on the bath. Consequently, when coke is used to start reduction, care must be taken not to add it in excess or it may result in trouble later. In cases where no coke is used and reduction occurs, the carbon necessary for this action comes from the electrodes. Another theory has been advanced by B. Yaneske regarding this phenomenon. In a paper read before the British Iron and Steel Institute in 1913 he has the following to say in reference to the reduction of silicon from acid slags:

"Spoon samples of metal also are taken periodically and if a reasonable amount of stewing has been allowed after each ore addition with the bath kept consistently at as high a temperature as the refractories will stand, the samples will become more or less riddled with holes and the slag covering the metal is seen to rise in the spoon owing to the escape of gas. This is a true indication that a stage has been reached when the slag has become so highly siliceous that there is an excess of silica above that required to satisfy the reduced amount of basic oxides present. Consequently, this excess silica once freed from combination with the basic oxides.

(*Concluded on Page 977*)

Cut to this point——————→|

TYPICAL ANALYSES OF MISCELLANEOUS COMMODITIES USED IN FOUNDRY PRACTICE

By J. M. Quinn

Commodity	Name Symbol	Carbon C	Manganese Mn	Sulphur S	Phosphorus P	Silicon Si	Chromium Cr	Vanadium Va	Tungsten W	Purpose Used For
SPECIAL STEELS—										
High Speed Steel		0.60/0.70	0.20/0.30	.020/0.00	.020/0.00	0.15/0.25	3.50/4.00	0.95/1.25	18.00/19.00	Milling Cutters, Form Cutters, Dies, Reamers, etc.
High Speed Steel		0.60/0.70	0.20/0.30	.020/0.00	.020/0.00	0.20/0.30	3.50/4.00	0.50/0.75	16.00/18.00	Inserted Saw Teeth, Wood Working Tools, Special Dies, etc.
Alloy Tool Steel		0.55/0.60	0.20/0.30	.025/0.00	.025/0.00	0.50/0.00	2.50/3.25	.....	13.00/16.00	Valves, Fine Cutting Tools.
Alloy Tool Steel		0.40/0.50	0.15/0.25	.020/0.00	.020/0.00	0.15/0.25	3.50/4.00	0.80/1.00	13.00/14.00	Tong Bits for handling hot steel ingots.
Alloy Tool Steel		0.30/0.40	0.30/0.40	.020/0.00	.020/0.00	0.20/0.25	4.75/5.00	.....	12.00/13.00	Hot Heading Dies.
Alloy Tool Steel		0.25/0.35	0.25/0.35	.020/0.00	.020/0.00	0.20/0.30	3.40/3.60	0.40/0.60	9.50/10.50	Extrusion Dies.
Alloy Tool Steel		1.20/1.50	0.25/0.35	.020/0.00	.020/0.00	0.20/0.30	.....	.....	7.00/9.00	Cutting Chilled Iron, Roll Turning Tools, Rifle Barrel Drills.
Alloy Tool Steel		1.25/1.35	0.25/0.30	.020/0.00	.020/0.00	0.10/0.20	0.20/0.30	.....	2.40/2.65	Cutting Chilled Iron, Roll Turning Tools, Rifle Barrel Drills.
Alloy Tool Steel		1.00/1.35	0.20/0.30	.025/0.00	.025/0.00	0.15/0.25	.....	.....	1.00/1.25	All around Cutting Tool—Better than straight carbon Tool Steel.
Alloy Tool Steel		0.45/0.55	0.15/0.20	.020/0.00	.020/0.00	0.10/0.20	1.30/1.50	0.15/0.25	2.25/2.50	Chisel Steel for pneumatic tools—Light Work.
Alloy Tool Steel		0.35/0.40	0.20/0.30	.020/0.00	.020/0.00	0.25/0.35	1.75/2.00	0.20/0.25	1.75/2.00	Chisel Steel for pneumatic tools—Heavy Work.
Alloy Tool Steel		0.50/1.10	0.30/0.40	.025/0.00	.025/0.00	0.15/0.25	0.75/1.00	0.15/0.20	.....	Taps, Screw Dies, Punches, Cutters with hard cutting edge.
Alloy Tool Steel		0.80/0.90	1.40/1.60	.020/0.00	.020/0.00	0.15/0.25	.....	0.20/0.25	.....	Taps, Dies, Plug and Ring Gages, Press Tools.
Alloy Tool Steel		1.05/1.15	0.20/0.30	.020/0.00	.020/0.00	0.20/0.30	0.30/0.40	0.15/0.20	1.25/1.50	Press Tools, Punches, Dies, Taps, Reamers.
Alloy Tool Steel		1.00/1.10	0.15/0.20	.020/0.00	.020/0.00	0.20/0.30	.....	0.15/0.20	.....	Press Tools, Master Taps.
Alloy Tool Steel		0.40/0.50	0.20/0.30	.020/0.00	.020/0.00	0.25/0.35	1.20/1.30	0.20/0.25	1.75/2.00	Chisels, Rivet Sets, Mining Drills, Hollow Drills.
Alloy Tool Steel		0.50/0.60	0.20/0.30	.020/0.00	.020/0.00	0.40/0.60	0.75/0.85	.....	2.50/3.00	Punches, Dies—Gives hardness to great depth.
Alloy Tool Steel		2.00/2.25	0.20/0.30	.020/0.00	.020/0.00	0.15/0.25	12.00/13.00	1.00/1.10	.....	Punches and Dies for thin sheets.
Alloy Tool Steel		1.40/1.50	0.20/0.30	.020/0.00	.020/0.00	0.10/0.20	0.65/0.70	.....	3.85/4.10	Drawing Dies.
Alloy Tool Steel		0.90/1.00	0.85/0.95	.020/0.00	.020/0.00	0.15/0.25	3.25/3.75	0.25/0.35	.....	Rolls for Cold Rolling. Highly polished jewelers rolls.
Alloy Tool Steel		1.10/1.35	0.20/0.30	.020/0.00	.020/0.00	0.20/0.30	0.40/0.50	.....	.....	Twist Drills.
Ball Bearing Steel		0.95/1.20	0.30/0.40	.025/0.00	.025/0.00	0.20/0.35	1.20/1.55	.....	.....	Ball Races (Annular Bearings).
Ball Bearing Steel		0.95/1.05	0.20/0.25	.020/0.00	.020/0.00	0.15/0.25	1.40/1.50	0.10/0.20	.....	Ball Bearings and Rollers.
Ball Bearing Steel		0.95/1.05	0.25/0.35	.020/0.00	.020/0.00	0.15/0.25	0.50/1.00	.....	.....	Ball Bearings.
Tungsten Magnet Steel		0.60/0.70	0.20/0.30	.020/0.00	.020/0.00	0.10/0.20	.....	.....	5.25/5.75	Magnets.
Chrome Magnet Steel		0.80/0.90	0.20/0.30	.020/0.00	.020/0.00	0.15/0.25	2.00/2.20	.....	.....	Magnets.
Carbon Tool Steel—1st Grade		0.95/1.05	0.15/0.25	.020/0.00	.020/0.00	0.20/0.30	.....	.....	.....	Dies, Punches, Taps, Screw Dies, Chisels.
Carbon Tool Steel—2nd Grade		0.95/1.05	0.15/0.25	.020/0.30	.020/0.00	0.20/0.30	.....	.....	.....	Dies, Punches, Taps, Screw Dies, Chisels.
Carbon Tool Steel—3rd Grade		0.90/1.10	0.20/0.70	.025/0.35	.035/0.00	0.20/0.30	.....	.....	.....	General Tools.
Tungsten Valve Steel		0.55/0.70	0.20/0.30	.040/0.00	.040/0.00	0.15/0.25	2.75/3.50	.....	13.00/16.00	Exhaust Valves.

Do not cut—Fold along this line for binding

	Name Symbol	Carbon C	Manganese Mn	Sulphur S	Phosphorus P	Silicon Si	Chromium Cr	Nickel Ni	Molybdenum Mo	Cobalt Co	
Special Valve Metal		0.30/0.50	1.20/1.50	.040/0.00	.040/0.00	.....	.....	28.00/35.00	.....	.....	Valve and Carburetor Parts—subject to corrosion.
Special Valve Steel		1.20/1.50	0.20/0.30	.....	.....	0.40/0.60	11.50/13.00	0.40/0.60	0.60/0.90	3.00/3.50	Exhaust Valves.
Special Alloy Steel		0.40/0.60	0.60/0.80	.040/0.00	.040/0.00	.....	0.80/1.00	.....	0.30/0.40	.....	Jack Shafts, Drive Shafts, Heat treated Studs and Bolts.
Case Hardening Steel		0.08/0.15	0.50/0.70	.030/0.00	.030/0.00	0.15/0.20	.....	3.25/3.75	.....	.....	Case Hardened Crank and Cam Shafts.
Case Hardening Steel		0.15/0.25	0.50/0.70	.030/0.00	.030/0.00	0.15/0.20	.....	3.25/3.75	.....	.....	Gears, Bolts—all case hardened parts subject to high stress.
Case Hardening Steel		0.13/0.20	0.40/0.60	.030/0.00	.030/0.00	0.15/0.20	.....	4.75/5.25	.....	.....	Driving Gears—All case hardened parts subject to high stress.

Cut to this point——————→|

Note—This sheet may be cut along this line and one half folded over on the other to bind in 5 x 7 inch note book.

THE FOUNDRY DATA SHEET, DEC. 15, 1924
Payment will be made for all contributions on foundry and pattern shop practice suitable for publication

SUBSIDIARIES — GRINDLE FUEL EQUIPMENT CO.-SWENSON EVAPORATOR CO.

WHITING CORPORATION

(FORMERLY
WHITING FOUNDRY EQUIPMENT CO.

CRANES-FOUNDRY EQUIPMENT

RAILWAY SPECIALTIES

HARVEY, ILL., U.S.A.
(CHICAGO SUBURB)

May 31, 1923.

The Foundry,
E. 12th & Chestnut Sts.,
Cleveland, Ohio.

Gentlemen:

We have advertised in The Foundry for the past 25 years; in fact, we were one of the first concerns to advertise in the medium. Through these years of advertising, we feel that more business can be traced direct to our advertisements in The Foundry than any other methods we have used in trade paper advertisements.

We can say without hesitation, that we consider The Foundry the best medium to use either for old or new concerns desiring to tell their story to the foundry trade throughout the world.

During the past two years of depression, we materially cut our entire advertising appropriation, but during this time, maintained our two full pages in The Foundry.

It is with much pleasure that we recommend to anyone desiring to reach the foundry trade, to advertise in The Foundry - not only that it is a most efficient trade paper, but that their entire staff is most efficient, and a pleasure to work with.

Yours very truly,

WHITING CORPORATION

R. H. Bourne,
V. P. & Sales Mgr.

RHB*IB

Equipment Speeds Output

Continuous System Involving Mechanical Equipment for Handling Sand, Molds, Iron and Castings Has Resulted in Increased Production from a Decreased Floor Space in Auto Shop

IN ADDITION to the features described in THE FOUNDRY, Sept. 15, the operation of the foundry of the Wilson Bros., Foundry & Machine Co., Pontiac, Mich., represents many unusual features including the sand handling and mixing equipment, the mold conveyors in one section of the foundry and the methods and equipmet employed in cleaning the castings.

Sand cutters made by the American Foundry Equipment Co., New York, are utilized in the preparation of the sand in two of the main divisions of the foundry. These two sections are devoted to the production of a miscellaneous line of automobile engine castings and the floors are laid off in the orthodox foundry style extending from the wall to the gangway and with a molding machine either stationary or portable serving each floor. The third section formerly was equipped and operated in a similar manner. It is devoted to the production of cylinders and transmission housings and recently has been converted into a continuous molding and pouring unit. Special conveyors and sand handling equipment have been installed for the purpose.

Facing sand for all three divisions of the foundry is prepared in a long compartment 30 feet wide located between two main divisions of the foundry building and communicating with each through numerous suitable openings through the division walls. Old sand for the mixtures is piled in a great heap at one end and is trucked as required to a battery of three muller-type mixers made by the National Engineering Co., Chicago. These mixers as may be noted by referring to Fig. 11 are provided with loading buckets and are located approximately in the center of the long narrow chamber set apart for the preparation of the facing sand. The supply of new sand is hauled on trucks from the sand storage building as required.

The amount of old and new sand and the percentage of coal dust in the mixture for the facing sand used on various castings has been determined by a series of experiment. Standards have been established, to which the men engaged in preparing the mixtures must adhere closely. Constant supervision is maintained over this department and so far as possible, mechanical equipment is employed to reduce the factor of risk attached to any process in which manual labor is extensively employed.

The correct amount of material for a batch of facing sand is loaded into the bucket while it is in the position shown in the center of the illustration Fig. 11. The bucket, then is hoisted as shown in the third member of the group in the same illustration. Various schemes were tried with indifferent success to regulate the time the mixture should remain in the mixing pan. At one time a clock was set up in the vicinity and the employes were instructed to allow the mixture to remain in the pan for 10 minutes. Apparently the idea was entirely satisfactory, but upon a careful investigation, it was found that the men paid no attention to the clock. They guessed at the time and frequently guessed wrong. If the hands on the clock pointed to the even hour the attendants usually could follow the course of the minute hand for the 10 minutes required, but where the hands pointed to miscellaneous divisions on the dial at the time the pan was loaded, the effort involved, apparently imposed too great a strain, either on their intelligence or their patience or perhaps

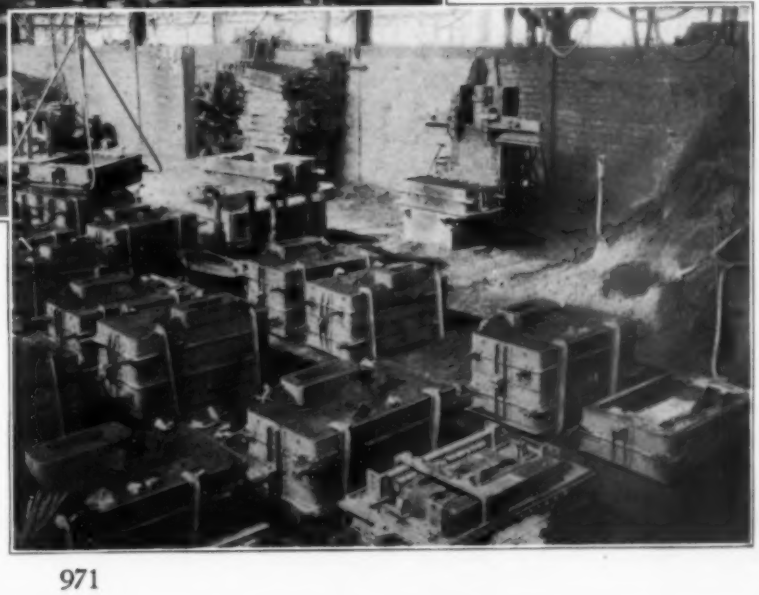


FIG. 1—CENTER DIVISION OF THE FOUNDRY WHERE MOLDS ARE MADE AND POURED ON THE FLOOR IN THE USUAL MANNER. FIG. 2—ILLUSTRATING THE LARGE FLOOR SPACE REQUIRED FOR CYLINDER MOLDS UNDER FORMER CONDITIONS OF OPERATION

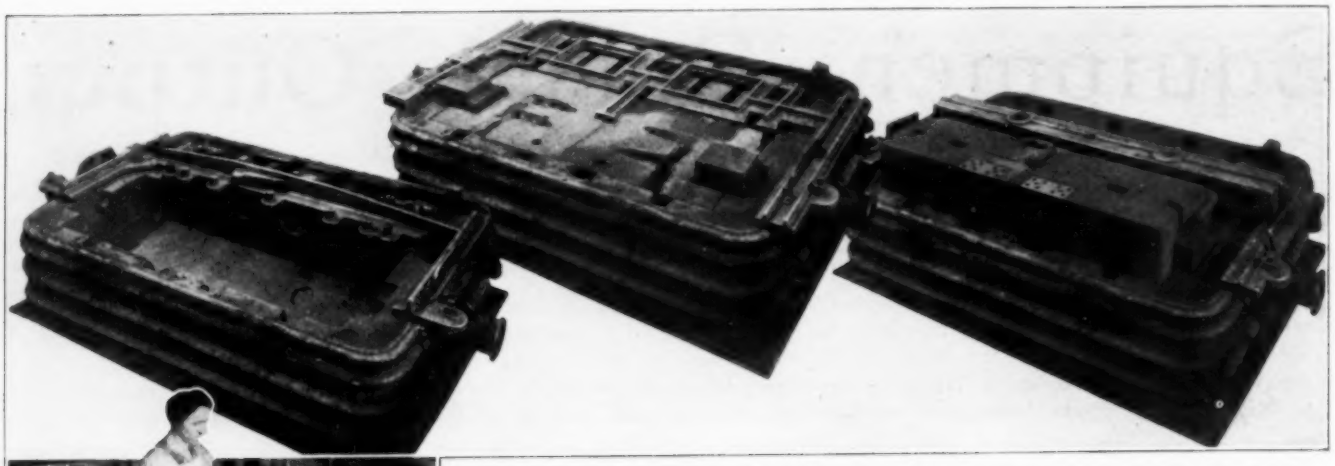


FIG. 3—5 AND 6—SEVERAL JIGS AND GAGES ALL DEPENDING FOR THEIR ACCURACY OF LOCATION ON THE PIN HOLES IN THE ENDS OF THE FLASK ARE EMPLOYED IN SETTING THE CORES FIG. 4—WATER JACKET CORES ARE REAMED IN A JIG BEFORE THEY ARE PLACED IN THE MOLD

both. Finally the superintendent hit upon a scheme that solved the problem. He had a sand glass made and attached to each mixing pan. By a little manipulation of the amount of sand in the glass, the correct amount was determined to indicate a 10-minute period. Now when the pan is loaded the attendant reverses the glass and allows the mixer to run until the measuring glass is emptied. The two operations are tied together so closely that the probability of error is eliminated. With one hand the operator starts the motor which drives the rollers, and immediately reverses the sand glass with the other hand. The action practically is automatic. At the close of the period, that is when the last of the sand in the upper chamber of the measuring glass has flowed into the lower chamber, the motor is stopped and the pan is unloaded. The sand glasses were made in the company's tin shop and are rectangular in cross section, instead of conforming to the familiar circular form in which these devices usually are presented.

After the facing sand has been mixed thoroughly in the pan, it is discharged upon a belt which extends from a point where the conveyor pulley shows at the extreme left of the illustration Fig. 11 to the near end of the set of steel bins shown at the extreme right of the same illustration. The belt discharges the sand into a hopper from which it is taken by a bucket elevator which feeds a horizontal flight conveyor traveling over the open tops of the storage bins. Suitable plows located above the conveyor, divert the sand into any required bin.

The floors of the bins slope down on both sides from the center and in that manner facilitate the flow of sand through the doors on both sides. The battery of sand storage bins is supported about 5 feet above the floor on concrete piers, an arrangement which permits light two-wheel trucks to back under the door to receive their loads. Brick is employed for the floor in this as in every other part of the group of buildings with the exception of the coreroom.

Conveying and other equipment shown in Figs. 15 and 16 recently has been installed in the newest section of the foundry for the production of cylinder and transmission housing castings on a continuous basis. The cylinder molding unit is shown in Fig. 15 and the transmission housing unit is shown in Fig. 17. The two units are arranged on the floor in such relation to each other that the finished molds travel to a common point between the ends of the two units where the sand is shaken out over gratings in the floor. A reciprocating conveyor at the bottom of a tunnel under the gratings carries the sand to a long belt which eventually discharges the sand into a revolving screen near the end of the building shown in Fig. 12. This screen is the first part of the equipment assembled at this point for the reconditioning of the sand. In fact, two complete units arranged side by side have been erected by R. W. MacIlvaine Co., Chicago, according to plans submitted by the Stoney Foundry Engineering & Equipment Co., Cleveland. The two units have a combined handling capacity of 220 tons of sand per hour.

Briefly it may be stated that in addition to the feature already indicated, the cycle of sand movement includes the following stages: From the revolving screen it is taken by a broad belt

FIG. 7—TIRE MOLDS FOR PART OF THE OUTPUT IN THE OLDEST DIVISION OF THE FOUNDRY—THE MOLDS ARE RAMMED ON A ROLLOVER JOLT MACHINE AND THE CASTINGS ARE POURED FROM A HARD CLOSE GRAINED IRON

FIG. 8—TRANSMISSION HOUSINGS ARE LOADED ON A WOOD SLAT CONVEYOR WHICH CARRIES THEM OUT OF THE BASEMENT TO A SHIPPING PLATFORM

to a bucket elevator which discharges it at a height of 40 feet upon a horizontal belt leading to a large hopper with a capacity of 320 tons. The sand is sprinkled with water before it enters the hopper. The hopper constantly feeds the sand through an opening in the bottom to a steel flight conveyor, which discharges it upon a short belt feeding a revivifying device designed by A. G. J. Rapp, chief engineer of the Link Belt Co., Chicago.

In this device the sand falls through a revolving paddle wheel which throws it through a great number of 1-inch steel rods suspended from the cover of the mixing device in staggered formation. The wheel mixes the sand and the rods serve to distintegrate any lumps that may fly from the wheel. The aerated and reconditioned sand falls through an opening in the bottom of the mixing chamber upon a long belt which carries it horizontally above the steel beams supporting the foundry roof and discharges it into a number of hoppers, one above each of the eight sand throwing machines comprising the mold making equipment. The sand feeds at a predetermined rate through the bottom of the hopper, through the sand thrown, into the flasks and finally arrives at the shakeout station where it is dumped through the grating in the floor and once more started on its journey around the circuit.

New sand is added in definite proportion to the stream of sand as it flows past on the belt on its way to the revolving screen. A hopper erected at a point about half way between the shakeout grating and the screen is loaded with new sand from a grab bucket. The bottom of the hopper is provided with an adjustable gate through which the sand may be fed steadily and at any predetermined rate. It is claimed this method is more economical and produces a more uniform mixture than where the sand is added one shovel at a time through the shakeout grating.

FIG. 10—SAND AND RODS ARE RECLAIMED AT A POINT CLOSE TO WHERE THE CASTINGS ENTER A TUNNEL LEADING TO THE BASEMENT UNDER THE MACHINE SHOP

FIG. 9—CASTINGS ARE HAULED ON TRUCKS FROM THE VARIOUS PARTS OF THE FOUNDRY AND LOADED ON A POWER DRIVEN CONVEYOR WHERE THE CORES ARE REMOVED WHILE THE CASTINGS ARE IN TRANSIT TOWARD THE CLEANING ROOM

The general arrangement of the molding machines, patterns, hoists and triple-branch conveyor is shown in Figs. 15 and 17. It may be noted that both are practically alike, with the necessary minor differences involved in the pattern equipment for cylinders and transmission housings and the monorail hoists by which the flasks are handled. A description of one will serve for both.

The gravity conveyors 125 feet in

length, made by the Dow Co., Louisville, Ky., presents several interesting features. The 4-inch rollers are mounted in 10-inch channel beams which in turn are supported on short pieces of 6-inch I-beams attached to pedestials anchored on the floor. It is claimed this form of construction insures a strong, rigid conveyor on which vibration of the molds practically is eliminated. Although assembled as a single unit the conveyor is a double piece of equipment. It is made up of three members. Two on the outside connected by a loop at the high end and one straight, level member in the center extending from the shakeout grating at one end to the loop at the other end. The molds flow in a continual stream from the loop to the low end on each of the outside members. The empty flasks are returned on the straight center member to the molding stations.

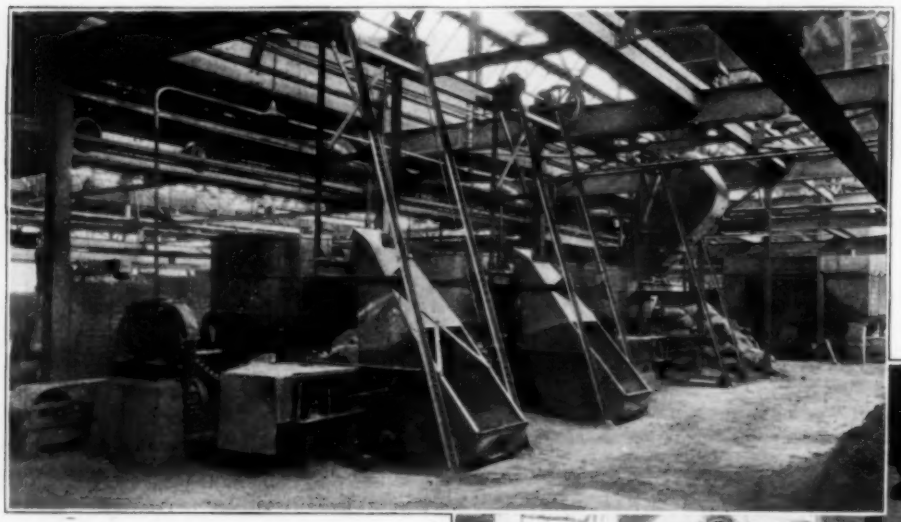


FIG. 11—FACING SAND IS PREPARED UNDER RIGID SPECIFICATIONS REGARDING MATERIALS EMPLOYED AND TIME UNDER THE ROLLERS

Making The Molds

Four sand throwing machines of the stationary type set up in pairs, back to back within the loop of the conveyor ram the sand in 1200 cylinder molds a day. These machines were made by Beardsley & Piper Co., Chicago. This production is obtained with 100 flasks, 50 to each side that go through the cycle of molding, pouring and shaking out 12 times a day. One of the principal advantages claimed for the continuous molding and pouring system is that it conserves floor space. For example, where the molds are made in the usual manner and each flask is used only once a day it is apparent that a floor area of approximately 12,000 square feet will be required to accommodate 1200 flasks. The space required for the continuous system does not depend on the number of flasks. Only sufficient floor space is required to support the conveyors and auxiliary equipment. In the present instance this amounts to less than 6000 square feet.

Two patterns are mounted on stripping plates between each molding machine and the conveyor. Flasks are placed on each pattern alternately, rammed full of sand, lifted, rolled over, examined and placed on the conveyor. The drag machine is nearest the loop. With this arrangement it is possible to set all the cores in the drag, before it arrives opposite the cope machine. The cores are brought in from the coreroom on racks suspended from a monorail and also on trailers attached to electric tractors. The rate of core supply synchronizes with the speed with which the molds are placed on the conveyor.

FIG. 12—A LONG BELT BRINGS THE SAND FROM THE SHAKEOUT GRATINGS AND DISCHARGES IT INTO A REVOLVING SCREEN WHICH IS THE FIRST STEP ON ITS WAY TO RECLAMATION

Process of setting the cores in a cylinder mold as shown in Figs. 3, 5 and 6, is facilitated by the employment of several jigs and gages which determine automatically and without any chance of error the proper position of each core, of each individual part of that core and of the proper thickness of metal between adjacent cores. The process involves a certain degree of speed and skill on the part of the operator, or more properly speaking, the many operators, but the equipment reduces to a minimum the hazard incident to the manufacture of castings of such a highly intricate character.

Transmission Housings

Method of making the transmission housings differs slightly from the method described for the cylinders. This is due to the fact that the core is made up of a green sand half and a dry sand half, instead of the usual all dry sand core. The molds are made on two pairs of sand throwing machines, two working on cope patterns and two working on drag patterns. The cores are made on two plain rollover machines supplied by the Grimes Molding Machine Co., Detroit. One core machine is used in conjunction with each pair of molding machines.

A half corebox attached to the core machine is rammed full of green sand. The joint surface is lightly pasted after which a dry half core is matched on top of it. The drag half of the mold then is inverted and lowered over the dry half of the core until the joint comes to rest on the joint of the corebox. Corebox and drag are clamped together, rolled over as a unit and placed on the conveyor where the corebox is removed. The cope, made on the adjacent machine then is lowered into place on the drag. The iron core arbor projecting from the dry sand core at each end serves as an anchor by which the core is wedged down from the flange of the cope half of the

flask. Dry half cores are stacked on the platforms spanning the conveyor and shown in Fig. 16. They are taken from the platforms as required and assembled on the green halves made on the machines, one of which is shown immediately back of the center platform.

Cores Located Carefully

Since this photograph was taken the platforms have been discarded. A section of the conveyor has been removed at the loop to permit the entry of a truck loaded with cores.

Several successive steps in coring a cylinder mold are shown in Figs. 3, 5 and 6. It may be noted that the pin holes in the flask serve as a basing point for all measurements. The greatest care is observed in maintaining the pins and pin holes in perfect condition, on the pattern plate, the flasks and the jigs employed in locating the cores. They are inspected periodically and adjusted when necessary. Where metal thicknesses are limited to 3/16 inch, a few thousandths one way or the other is a matter of considerable importance.

FIG. 13—CASTINGS ARE LIFTED STEADILY FROM THE CONVEYOR AS THEY ARRIVE FROM THE FOUNDRY AND ARE LOADED ON TRUCKS WHICH TAKE THEM TO THE CLEANING DEPARTMENT

Castings from all three main divisions of the foundry are loaded on long, low steel trucks and hauled to a point in the old foundry leading to a tunnel under the railroad tracks which separate the foundry building from the machine shops. They are lifted from the trucks to a power driven conveyor where the cores are removed by several workmen standing on each side armed with suitable tools. The rods and wires are loaded in boxes and returned to the coreroom where they are placed in stock for the coremakers' use. If necessary they are again bent to shape in one of the machines referred to in a former article. If through crystallization or any other reason they are not considered worthy of reclaiming they are thrown in the miscellaneous small scrap box and taken to the charging deck of the cupola.

The sand drops through the slats in the conveyor and falls onto a belt which discharges into the boot of an elevator serving a storage hopper. At periodic intervals a railroad car is spotted on the track outside this corner of the building and the sand from the hopper flows through a spout into the car. A magnetic separator reclaims the scrap on the belt before it falls into the boot of the bucket elevator. Lumps of cores, prints and other parts in which the sand has not been burned, are shoveled into a small tumbling barrel in which they are crushed once more into the form of sand which is returned to the coreroom and mixed in varying proportions with the sand for certain of the thicker cores.

Two ends of the conveyor on which the castings travel through the tunnel from the foundry to the basement under the machine shop are shown in Figs. 10 and 13. It may be noted that the same type of hook and lifting equipment employed to place the casting on the entering end of the conveyor Fig. 10 is provided at the discharge end Fig. 13 for removing them. Electric trucks bring the loaded cars to one end of the conveyor and take them away from the other end. On account of the greater traction and also with a view to reducing the dead weight of the conveyor, the conveyor slats are made of hard wood instead of steel.

FIG. 14—CYLINDER CASTINGS ARE MOVED ON ROLLER CONVEYORS FROM THE VARIOUS CHIPPING AND GRINDING STATIONS TO A LONG POWER DRIVEN CONVEYOR ON WHICH THEY RECEIVE A FINAL INSPECTION

Other views of the cleaning room in the basement under the machine shop are shown in Figs. 8 and 14. In both cases it may be noted that the conveyor takes an upward slant at the far end. The cylinder castings shown in Fig. 14 are taken up to the machine shop and the transmission housings shown in Fig. 8 are taken up to a shipping platform where they are loaded on railroad cars.

Cleaned in Tumbling Barrels

The castings first are cleaned in ten batteries of tumbling barrels, five to a battery, made by the W. W. Sly Mfg. Co., Cleveland. From the tumbling barrels the castings are lifted to a conveyor where they are chipped as they travel along. Any casting that is not cleaned sufficiently in the tumbling barrels is given a supplementary treatment in one of two cabinet type sandblasting units made by the American Foundry Equipment Co., New York. The castings receive a severe inspection at

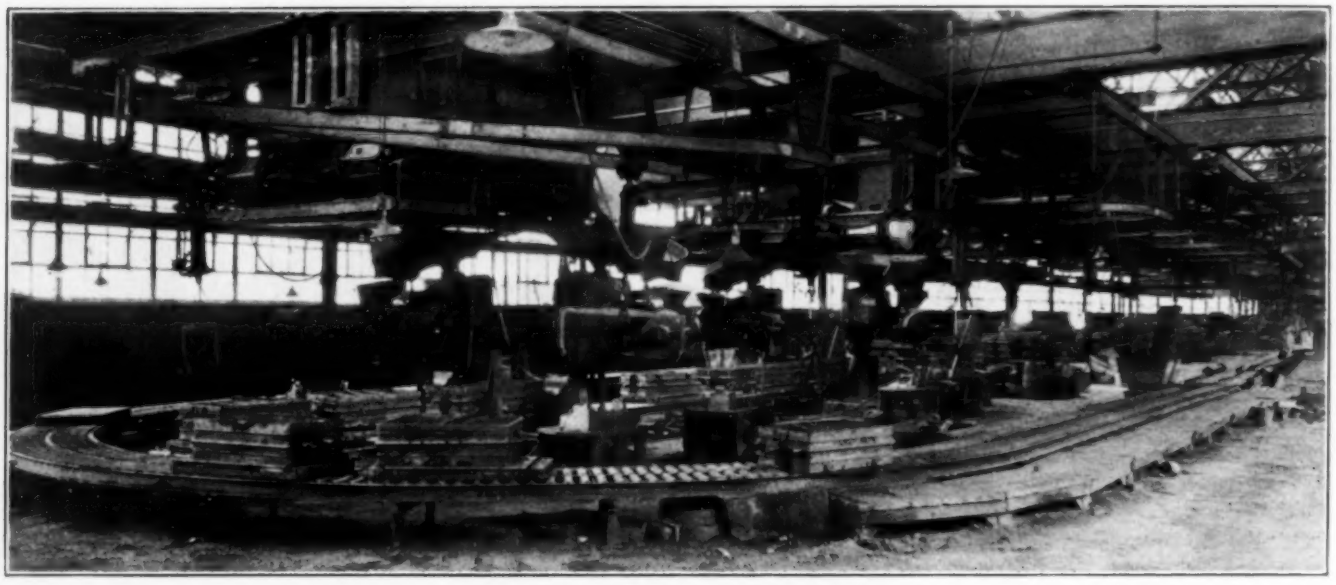


FIG. 15—CYLINDER MOLDS ARE MADE ON FOUR SAND THROWING MACHINES ARRANGED BACK TO BACK IN PAIRS INSIDE THE LOOP OF THE CONVEYOR

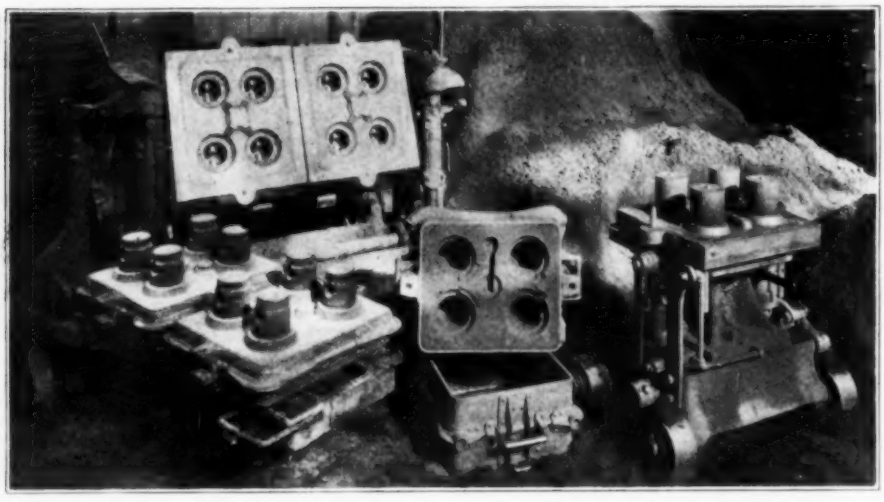


FIG. 16—ILLUSTRATING METHOD, MACHINES AND EQUIPMENT EMPLOYED IN MAKING PISTONS FOUR IN A FLASK FOR AUTOMOBILE ENGINES

several points on the journey, but are not water tested. The defective castings are removed from the line and marked in a suitable manner to indicate whether they are to be taken to the scrap pile or to the welding room. Those falling into the latter category are loaded on trucks specially designed for the purpose.

Heat treating, welding and repairing is carried on in a building adjoining the main cleaning room. The pistons are heat treated by passing them through a long oven open at both ends and provided with long continuous grooves in the floor which extends on a steadily lowering incline from the receiving to the discharge end. The pistons are fed by hand steadily at the upper end and as continually push the pistons out at the lower end. The oven is heated by oil to a temperature of 1300

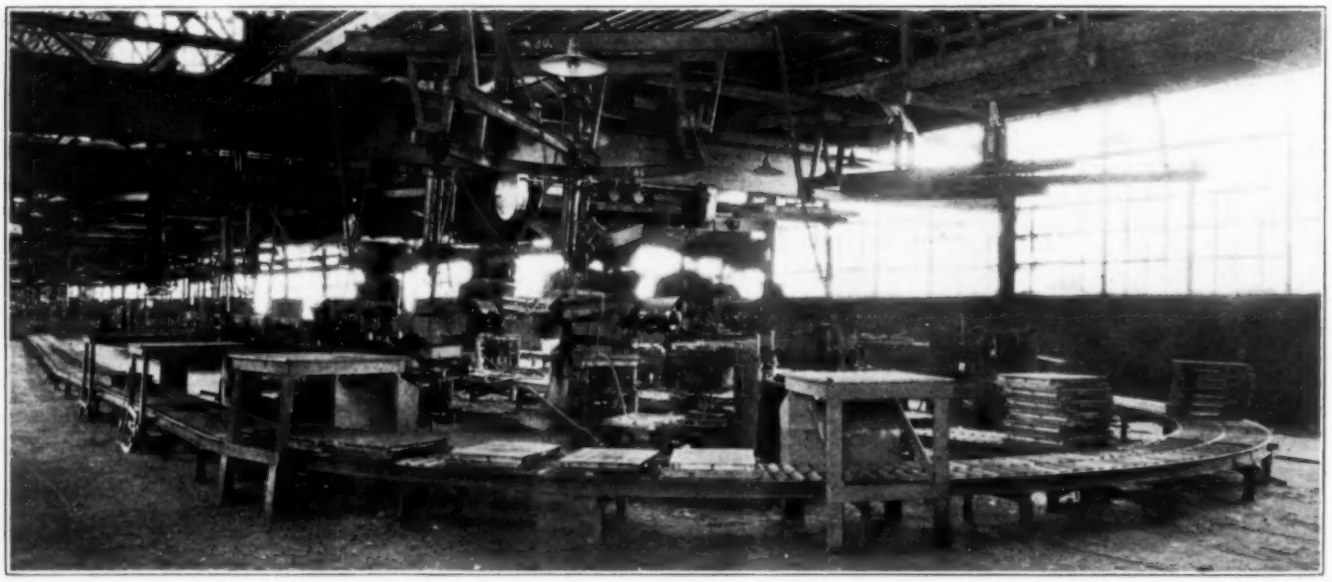


FIG. 17—CORES FOR THE TRANSMISSION HOUSINGS HALF GREEN AND HALF DRY ARE ASSEMBLED ON ROLLOVER MACHINES LOCATED CLOSE TO THE MACHINES ON WHICH THE MOLDS ARE MADE

degrees Fahr. in the center and each piston remains in the oven for approximately 30 minutes. Under ordinary conditions 4500 pistons are treated daily.

The chamber in which the cylinders are brought to a bright red heat before they are repaired is fired with oil and has a capacity for three cars. The track passes through the oven which is provided with doors at both ends and in that manner the first car to enter at one end, also is the first car to leave the other end. A pneumatic pusher is employed to force the cars through the chamber. A special asbestos lined cover is placed over the castings on each car after they have been repaired. The cover retains the heat in the castings and allow them to cool slowly thus preventing accidents due to strains set up when castings cool unevenly.

For the benefit and convenience of the employes of the Wilson Bros. Foundry & Machine Co., a commissary service is maintained where many small articles may be secured in addition to the food and beverages supplied before, during and after lunch time. First aid stations are located at three central points where minor injuries are treated instantly. A description of the aluminum foundry which has been equipped into a special manner for the continuous production of castings will be published in a forthcoming issue of THE FOUNDRY.

Refining Metals Electrically

(*Concluded from Page 970*)

begins to be reduced by the iron, the silicon passing into the metal and the oxygen liberated from the silica perforating the metal samples, thus:

$$Si\ O_2 + Fe = Fe\ Si + O_2$$

"In the furnace bath, where the slag is only in contact with the surface of the molten metal, the oxygen will escape from the silica reduced without passing through the metal. The author here ventures to disagree with several authorities who have stated that it is the carbon which effects the reduction of the silica according to the equation:

$$Si\ O_2 + 2\ C = Si + 2\ CO$$

"It is the author's opinion that iron must be a far more powerful reducing agent than carbon, for iron is always present in great excess, and it is an established fact that oxygen has a greater affinity for silicon than for carbon in the open hearth furnace (also electric under general operating conditions. L. J. B.) this being the basis of the acid process, therefore it seems highly improbable that carbon will displace silicon from combination with oxygen at the furnace temperature. For carbon to reduce silica according to the previous equation, it is easily calculated that there must be a loss of 0.06 per cent carbon from the metal for each gain of 0.07 per cent silicon from the slag, and yet analyses have proved to the author that the reduction of silica frequently has occurred to such an extent that the percentage of silicon passed into the metal from the slag has exceeded 0.10 per cent while the carbon in the bath has not fallen more than 0.03 per cent. In fact he always has found the loss of carbon to be less than normal whenever there has been a considerable gain of silicon from the slag, for whatever be the reaction it is obvious that for the silica to be reduced at all, the amount of oxygen dissolved in the metal must have reached a minimum. Therefore, it can only be by atmospheric oxidation from gases that the carbon is removed when the metal is free from the dissolved iron oxide. Iron in the absence of dissolved oxygen is also liable to reduce some of the silica of the hearth, particularly when the hearth has been newly sanded, the silicon passing into the metal being subsequently oxidized by the further addition of iron ore, thus causing an increase in the silica content of the slag."

While it is not the purpose of the writer to argue upon the relative merits of differing theories it must be here stated that the theory advanced by Mr. Yaneske, while not being the accepted one, is in a great way correct. While we cannot know exactly whether or not it is iron or carbon which causes the reduction, an experiment proving the above theory will be explained.

Melt a heat of steel, and work exactly as for an ordinary soft casting heat. Keep the slag in a fluid condition and heat up to a high temperature. As long as this slag is kept fluid, by additions of lime, there will be no silicon pick up, no matter how high the bath is heated, or how long the metal is held at such a temperature. Now still keeping the slag fluid add carbon to the slag in the form of coke dust. The carbon in the metal will increase slightly, but as long as the slag is kept in a fluid condition there will be no increase in silicon. Metal tests taken under these conditions always will show fairly sound, and will not rise in a chill mold. When broken they will show sound metal around the rim, with no evidence of gas holes. The slag will be a perfect color, the familiar light yellowish green. If the heat is poured with silicon added in the ladle, the steel will be perfect.

Now, without allowing any oxidizing influence to enter the furnace, allow the power to be shut off long enough to permit the metal to chill slightly so that there cannot be any question as regards a higher temperature causing the reduction, quickly open the doors and spread enough sand over the slag to thicken it to a rather heavy condition, but not to a special or unusual thickness. Turn the current on and quickly note the silicon pick up. The metal tests will begin to rise in the molds, and upon being broken will show the familiar network of blow or gas holes, the slag being of exactly the same color, but considerably thicker. Now there is no way to explain this but to assume that the oxygen of the silica has contaminated the metal. If manganese is added here the steel again will show a sound conditon.

This reduction of silicon can be accepted as coming under the following phases:

1—Reduction from the siliceous hearth material, the action being caused by either iron or carbon from the metal itself.

2—Reduction due to increased silica content of the slags. This can be eliminated in part by a judicious use of lime.

3—Reduction from the silica of the slag by carbon, coming either from the electrodes, or from coke added to the furnace.

4—Reduction due to increased slag temperature.

It will be found that the reduction of silicon always is the heaviest on the first few heats from a newly lined furnace, and is readily explained by the increased slag volume caused by a first running or spalling of the fresh brick.

Linseed Oil Is Employed As a Corebinder

Question: What is the proper amount of linseed oil and what kind of sand should be used for making small cores for thin iron castings. We have experimented to some extent and have baked the cores thoroughly but find that if we add sufficient linseed oil to render the sand workable, the cores bake exceedingly hard and cause the iron in the molds to blow.

Answer: Linseed oil is employed extensively as a core binder and we are rather at a loss to determine why your experience with it should be of such an unsatisfactory character. It is possible that you are using perfectly dried sand and depending on the binder to dampen it to a point where it may be worked. If that is the case the remedy is obvious. Add just sufficient oil to bind the sand and then add water to make the sand workable. This will vary to some extent depending on the character of the sand and the size of the grains. One measure of oil to 40 of sand has been found to yield satisfactory results in many cases and we suggest you commence with that proportion and then increase or decrease the amount gradually until you arrive at the ideal amount. Water is added to the sand in any desired quantity to temper it so that it may be manipulated in the box and afterward. Sharp sand exclusively is employed. One of the most important features in connection with the preparation of oil sand mixtures is that the sand and binder must be mixed thoroughly.

Describes Bell Founding-III

Gives Composition of Bronze Used in Making Large Bells—Study of the Characteristic Constitution or Microstructure of the Cast Metal an Important Feature in Bell Founding

BY WESLEY LAMBERT AND G. HALL

METAL *par excellence* for large bells is essentially an alloy of copper and tin. Large bells have been cast in other metals or alloys, as, for instance, in aluminum-bronze and in steel. Lord Grimthorpe, an eminent authority on clocks and bells, when asked his opinion of some bells cast in steel, replied: "If the object of the bells is to make the greatest noise for the least money, steel bells are good, but the less you ask me to say about the quality of the noise the better." Bell metal is a true bronze, in that it is compounded from, copper and tin, the former metal being present in predominating quantity. The alloy, 80 copper 20 tin, passing under the name of bell metal, is quoted in books of reference more often than any other alloy of these two metals. It is common knowledge among persons interested in metal for bell founding that a fairly large departure from the 80:20 alloy is permissible without sacrificing the strength or tone of a bell. All metals are resonant when struck under favorable conditions; even lead, cast in the form of a hollow spherical segment, being sonorous.

The first requisite of a good bell metal is that it should be pleasingly sonorous when struck, the sound produced being of a full, rich, and pure tone.

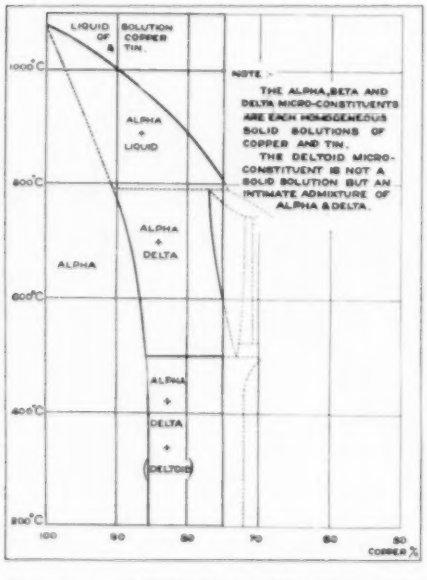


FIG. 10—A PORTION OF THE THERMAL EQUILIBRIUM DIAGRAM OF COPPER-TIN ALLOYS

Other requisites are comparative cheapness and good casting properties. In these respects the alloys of copper and tin, or the true bronzes, possess such qualities in a marked degree. The 80:20 alloy is a good example in a somewhat wide range of these alloys. To ensure a pure full sound from a bell it is not only necessary to employ a suitable alloy and correct proportions for the bell, but the casting must be sound, free as possible from blemishes, slag, oxide inclusions, and should be representative, in every respect, of the best art of the foundryman.

Nowadays, the foundryman has but little say in respect to either the shape or proportions of the bell to be cast, and merely acts upon instructions received from the designer. Nevertheless, he is expected to produce a casting which will result in an almost perfect musical instrument.

Tin Content Important

The range of the true bronzes which may be said to constitute the genuine bell metal alloys suitable for the founding of large bells is represented by the difference between a tin content of 17 per cent on the one hand and 25 per cent on the other. Authentic analyses of large bells cast in by-gone days give figures well outside the range indicated, but little is known as to the fullness or purity of sound emitted by these bells. Bell metal containing from 20 to 24 per cent of tin, with a leaning toward the higher amount, is claimed by some authorities as representing the ideal alloy for large bells. This being the case, it follows that if the furnace charge is to include an admixture of scrap in the form of old bells, the resulting alloy only may closely approximate the ideal when *mixture by analysis* is employed in making out the furnace charge sheet. The intentional introduction of other metals additional to copper and tin, although favored by some bell-founders, is of doubtful advantage. Where scrap also is included in the melt, the adoption of the *mixture by analysis* method of calculating the charge is rendered almost imperative if successful and concordant results are desired.

The rich sonorous qualities of the bronze used for large bells such as church bells, is said to be due to the characteristic constitution or microstructure of the metal in general use for this class of bell. Fig. 10 represents a portion of the thermal equilibrium diagram of the copper-tin alloys. This diagram in its entirety is of a somewhat complex character. For the sake of simplicity, only that portion of the diagram covering the copper-tin alloys having a bearing on the constitution of bell metal has been included.

Reference to this diagram will show that those alloys containing from little or no tin up to as high as 13 per cent of this metal, when cast and allowed to cool slowly to the ordinary atmospheric temperature, consist wholly of a solution of one metal in the other and are therefore of homogeneous structure. Only one microconstituent is observable under the microscope. The alloys with a tin content of between 13 per cent and 28 per cent when cast and slowly cooled are found to consist of two solid solutions, one richer in tin than the other, in addition to the two solutions a further constituent is in evidence, this being an intimate admixture of the two solutions, and itself possessing different physical properties from either the first or second solid solution. The first solution is designated the alpha, the second solution is known as the delta; the intimate mixture of the two solutions is known as the deltoid constituent.

It is necessary to point out that in the foregoing explanation of the ther-

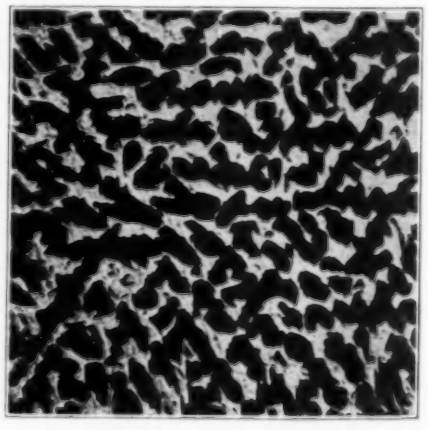


FIG. 11—PHOTOMICROGRAPH OF BELL METAL, THE DELTOID CONSTITUENT BEING THE WHITE PORTION

mal equilibrium diagram emphasis has been given to slow cooling of the alloys. Such a procedure as is indicated by the words *slow cooling* does not appertain in foundry practice. Bell metal cast under normal conditions and subjected to the usual cooling out may be regarded as constitutionally consisting of the alpha-solid-solution plus the deltoid constituent. To the presence of this latter constituent, distributed throughout the alpha-solid-solution, is ascribed the pleasing sonorous quality of bell metal round about the 80:20 type of alloy. The more uniform the distribution of the deltoid constituent, the more likely is the bell metal to possess a full rich tone.

Fig. 11 is from a photomicrograph of an alloy of the type mentioned, the deltoid constituent being the white portion. The etching reagents most suitable for the preparation of specimens of bell metal for examination of the microstructure are: A solution of ferric-chloride, useful as a means of identifying the deltoid constituent, which is rendered visible as a bluish-white constituent upon etching the metal with this reagent and a solution of sodium-picrate, which reagent serves to darken the deltoid constituent.

The mechanical properties of ordinary sand-cast bell metal at atmospheric temperature may be noted briefly. The tensile strength is round 33,600 pounds per square inch. Those alloys with a tin content of 18 per cent and over have no elongation, and generally speaking, are hard and brittle. These properties are accentuated more as the tin content of the alloy increases. Annealing in the case of castings in these alloys renders the distribution of the hard constituent more uniform, with less liability of failure under the stresses set up by severe shock or repeated impact on the metal by the bell knocker.

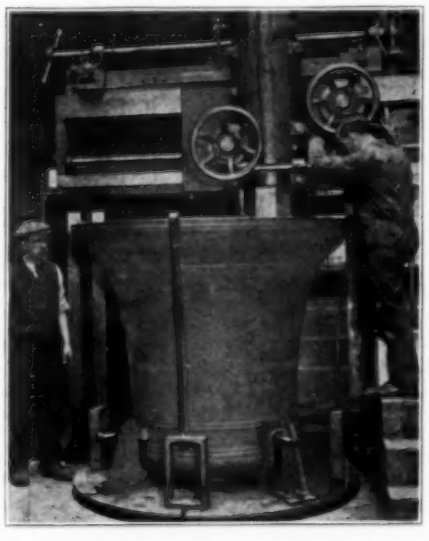


FIG. 12—BORING THE INTERIOR OF A LARGE BELL

The inherent brittleness of castings in the tin-rich cupreous alloys makes the addition of other metals attended with risk. In some foundries no metals additional to copper and tin are intentionally introduced. The presence of any other metal which may be found in the casting being accounted for by the use of scrap in the mixture.

Lead often is present to the extent of 1 to 4 per cent. The one time popular idea that an addition of silver improved the tone of bells is without foundation, and has been abandoned. The author cannot justify on metallurgical grounds the sacrifice of the Chinese foundryman's daughter who plunged into a bath of molten bell metal to ensure a soft tone for the temple bell about to be cast. It is well known that exceedingly brittle metal should not be used in a bell casting, neither must the alloy be too soft.

FIG. 13—FINISHED BELL A GOOD EXAMPLE OF THE MODERN BELL FOUNDER'S ART

The useful life of the bell is to a large extent dependent upon its capability of resisting the effect of repeated blows.

The color of good cast bell-metal has been described as a peculiar gray-white. A newly fractured piece of cast bell metal of the 80:20 type exhibits a white gray, more or less crystalline surface, not infrequently spotted with small golden yellow patches. The presence of the latter is more noticeable in the absence of pressure feeding. The yellow patches indicate a lack of sufficient liquid metal to comply with the demand of crystal growing during the transition period which denotes when the metal as a whole passes from the partially liquid to the all-solid state. The bright yellow color of the patches is due to the light reflected from the undamaged natural surfaces of the members of the partially formed crystals.

The dendritic structure of a newly fractured piece of bell metal, as viewed under the microscope, is characteristic of the high tin bronzes when cast at suitable temperatures, and the structure serves in a useful way to grade these bronzes in relation to the percentage of tin in a particular alloy.

FIG. 14—A LARGE BELL WITH INSCRIPTION

Compounding a mixture of copper and tin to form a bell metal alloy is not difficult. The bronze either may be ingotted and remelted, or made and used direct in a casting. The manufacture of ingot bell metal follows the usual practice carried out in the making of ordinary high grade bronze ingot, and calls for no special remarks. The furnace charge for the casting of large bells generally is prepared from either ingot copper or heavy scrap copper. An addition of a liberal weight of old bell metal, if available, often is favored. The requisite quantity of tin is added just before tapping, the weight of tin to be added depending largely upon the quality of the alloy desired, the weight of copper included in the charge, and the weight and composition of the scrap. When large quantities of copper are melted, poling is sometimes followed to bring the copper into its best condition. Charcoal is added to the furnace charge, and furnishes a suitable cover to protect the metal. For large casts an open-hearth air furnace generally is employed, and proves quite suitable for this purpose. Pyrometric control of the melting and pouring temperature is desirable when the best results are demanded.

Shrinkage Usually May Be Traced To Iron

Question: We shall appreciate your opinion on the probable cause of trouble we are experiencing with cut gear castings. These castings vary from 15 to 30 inches diameter and are of the usual type with six arms. We have made these gears for about six years and never had any trouble until a few months ago and have had almost continual trouble since that time. When the

casting is machined we find a dirty or spongy spot at the junction of one or two of the arms with the rim. The remainder of the face turns up perfectly clean. We have tried various gating methods and also have tried pouring the casting with iron at various temperatures, but the result is the same in all cases. Our iron shows the following analysis and we believe should be satisfactory for these castings: Silicon 2.57 per cent, sulphur 0.07 per cent, phosphorus 0.66 per cent, manganese 0.69 per cent, graphitic carbon 2.98 per cent, combined carbon 0.49 per cent. We experience practically no trouble with larger gears up to 48 inches diameter.

Answer: The analysis of your iron is ideal, you have been making the wheels successfully for several years and larger wheels practically are immune from shrinkage defects. In the face of a combination of that character it is apparent that some factor out of the ordinary is responsible for the condition to which you refer. The fact that the large wheels do not show defective areas would lead to the inference that the design of the small wheel is at fault. Almost without exception a *draw* will develop at the junction between a heavy and a light section, particularly if the sections touch at a right angle. As a preliminary step we suggest that you make the arms heavier either by lagging the pattern or by cutting away the sand after the removal of the pattern from the mold.

The usual remedial measure to apply when shrink holes develop in the castings is to raise the silicon in the iron by the addition of a larger proportion than usual of the pig iron in the cupola charge. A possibility exists that you may have cut down on the pig iron content in recent months. An ill proportioned casting that might show no shrinkage areas with a high silicon iron, inevitably will develop spots of this character when the silicon is lowered. Shrinkage spots sometimes may be traced to the use of burned or oxidized scrap or to scrap that has been remelted a great number of times. In other cases a high blast pressure has been found to be responsible. In a few rare instances evidence pointed to the pig iron and while no direct proof could be adduced in support of the theory that the pig iron was lacking in some respect, still, when the charge was made up from another brand, the trouble disappeared. This despite the fact that the two irons showed a similar analysis. We suggest first that you change the design of the pattern so that a cross section of the arm more nearly approaches that of the rim. If that does not eliminate the shrinkage trouble, then raise the silicon content. If either or both of these remedies prove ineffective, you had better try a different brand of pig iron.

Melting Bronzes in Electric Furnaces

BY F. C. HEATH

THE greatest potential field for the electric furnace in the nonferrous industry, is in the medium sized foundry. In such foundries, as in our own, molding, melting, pouring and shaking out is a continuous process, with all operations going on at the same time. I believe that no one of our molders will have more than 16 molds standing at any one time, and from 8 to 12 of these will just have been poured. This means that our tonnage of 23,000 pounds per day is produced with the minimum amount of molding space. This condition requires a small furnace to preserve the flexibility of the coke fires.

The 250 pound electric furnace in use in our plant is exceedingly flexible, since it is necessary to wait no longer than a half hour if a quick change in the melting program is found to be imperative. We melt approximately 15 or 16 different bronzes, although no more than five or six are run in any one day. This also requires flexibility.

We have in operation at the present time five furnaces built by the Detroit Electric Co., Detroit, which are of the rocking type melting 230 pounds to the charge or the capacity of a number 70 crucible. Each of these furnaces are equipped with a 100 kilovolt ampere transformer built by the Kuhlman Electric Co., Bay City Mich., operating at an input of 90 to 100 kilowatt.

We originally equipped the furnaces with 60 kilovolt ampere transformers and produced around 12 to 15 heats per day. Our melting record now stands at 21 heats in one day, starting the arc at 6:15 a.m. and finishing at 3:15 p.m. After the first two or three heats, which always require more energy than the succeeding heats, the average time of melting was 17 minutes, with a loading and unloading time of 6 minutes, making a total of 23 minutes for the complete cycle. So far, our limiting factor in the speed of melting is the lining. The greatest number of heats that I know of being taken out of any one of our other type furnaces in a day is six, with a melting time of 1¼ to 1½ hours.

The operating advantages are as follows: The human element is largely eliminated and the field for obtaining labor widened; greater uniformity of product is obtained, each heat being melted under the same conditions as every other heat, as nearly as it is possible to do; the use of the crucible is eliminated except for carrying metal from the furnace to the molds; everything put into the furnace is melted and taken out with the resultant loss, according to our two days test of 0.6 per cent. We have found a melting loss of 2 per cent in our other type.

As mentioned previously, the linings are the limiting factor in melting. With the rate of input of 75 kilowatt, we had a lining last 2000 heats, but with the rate of input at 90 to 100 kilowatt it is not economical to run the lining over 1000 heats.

The average consumption of electrical energy per ton of our class of bronzes is 325 kilowatt hours with an electrode consumption of 6½ pounds per ton. We melt mixtures of 88 copper 10 tin 2 zinc; 80 copper 10 tin 10 lead; 85 copper 5 tin 5 zinc 5 lead; 85 copper 5 tin, 9 lead 1 zinc principally.

The following are some tests of the physical properties of coke and electrical fired furnaces, that have been made, analysis of metal being 85 copper 5 tin 5 zinc 5 lead.

		Electric melting	
	Coke fired	17 min.	25 min.
Elastic limit	15,565	16,560	16,610
Ultimate strength.	30,900	30,620	28,940
Elongation in 2 inches	17%	17%	18½%

These results show that the quality of metal in either process is equally good, and that fast melting in the electric furnace does not injure the metal.

So far as the comparative cost of melting is concerned, as near as can be estimated, there is about $3.50 per short ton of melt in favor of the electric melting with our equipment. This is an estimate, as we are still running coke and electric fires with the same operators, and it is difficult to separate the costs. However, I feel that this is accurate at the present prices of coke, electricity, etc.

From a paper presented at the Detroit meeting of the American Electrochemical society, Oct. 3, 1924. The author is chief engineer, Federal Mogal Corp., Detroit.

How and Why in Brass Founding

By Charles Vickers

Gating Stick Brass

We are making solid cylindrical bars of bronze ranging in diameter up to four inches. Some bars of the smaller diameters we get sound, but the larger sizes cause considerable trouble. The defects are so peculiar that we are sending samples from the castings to enable you to understand more fully just what the difficulty may be. The larger bars come with a cold shut on the cope side which may be chizelled away, leaving a depression in the casting which corresponds to irregularities of surface on the under side of the detached piece. The castings are made horizontally, and we have tried many different gating methods without success. The samples we send include two of the thick slivers detached from bars, and one circular section of a smaller bar to show a surface fractured while hot.

The molding and gating of *stick brass* was fully described in the course of several articles in former issues of THE FOUNDRY and we suggest a careful perusal of the same. In the first place the large bars are not being gated in a manner to prevent shrinkage. Briefly, they should be gated on the end from a riser, larger in diameter than the casting, and this riser gets its metal from a sprue of small diameter adjacent, the two being connected with a *gate* that will *choke* the metal so the sprue may be kept filled.

The peculiar detachable *sliver* is produced by the shrinkage of the casting on that part of its circumference that lies uppermost in the mold. This produces a hollow into which metal flows from other parts of the casting and riser that has not yet solidified. This metal has a lower melting point than that of the metal which forms the body of the bar, and which has just solidified and shrunk; it is richer in tin and other white metals, as shown by the fact the sliver breaks easily; it is brittle. The sliver is, what at one stage of the solidification, was a little pond.

It fails to adhere to the main casting because a parting was formed on the surface of the depression before the fluid filled it, this parting is formed by iron within the metal, also assisted by the oxides held in solution, and the metal is badly oxidized. The iron produces abnormal shrinkage of the alloy, and it is necessary to put on higher heads, and much thicker risers in the case of irony metal than for metal free of iron. In addition to iron, aluminum is present in small amount, and the two impurities make a nice combination for creating trouble. Much could be written on the subject, but if the molds are made and gated as described in THE FOUNDRY, and instead of using common junk, an alloy is made up to formula, even using scrap copper, there will be no further trouble.

Defective Bushings

We have made a number of brass bushings, casting them on end and find that the top when machined is porous and full of small red spots like the sample we are sending for inspection. The bottom of the bushing is sound and clean. The metal is composed of red brass scrap, and the mold is made of dry sand with a dry sand core. The castings are pop-gated on top, the metal being melted in an oil-fired noncrucible furnace.

The metal apparently carries an abnormal amount of oxides. The cause of such a condition we are not prepared to state. It may exist in the scrap or be introduced during the melting of the scrap. There is also a possibility this condition of the metal is caused by the mold setting up a disturbance as the molten metal enters and fills it. The sand should be as dry as it can be worked for vertical molding. It is necessary to decide where the difficulty originates. Make a special heat using all possible care in melting, use crucible furnaces with a good covering of charcoal over the metal. Pour a bar for a fracture test first. Make the bar 6 inches long by 1¼ inches square. When this bar is cold saw a nick in one side ⅛ inch deep, then break the bar with the sledge. If the metal is homogeneous there is nothing the matter with the scrap. Make another bar from the noncrucible furnace, and compare the two fractures. If both are homogeneous blame the molds. If the crucible bar is sound and uniform and the noncrucible furnace bar is not, then it is obvious where the blame lies. Having discovered this, make changes as necessary. If the scrap is oxidized, discard it for making these bushings and use ingot metal of known analysis. Deoxidizers are of no use in the case of badly oxidized metal. The crucible refining of bronze is difficult.

Fuel Consumption of Furnace Good

We desire information on oil-burning brass melting furnaces. We have noted that preheated air is used in some furnaces and not in others, and that some are fitted with a combustion chamber and others not. The oil fired furnaces we use are home made being simply the old coke furnaces with a hole cut in the side for the burner which is made of pipe. Using 25 specific gravity fuel oil, we melt 450 pounds of scrap brass in three hours with 10 gallons oil. We imagine more metal could be melted with lower fuel consumption if the furnace walls were built nearer to the crucibles and a tight fitting cover used.

Average consumption of oil per hundred pounds of metal melted by 10 brassfounders, selected at random from the statistics given by H. W. Gillett in bulletin 73 of the bureau of mines is 2.46 gallons. This average leaves little room for criticism of the performance of the home made furnaces mentioned, and it is doubtful if sufficient improvement may be made to justify the expense. It is only necessary to use a larger crucible to decrease the space between the crucible and the walls of the furnace. Therefore, the theory of greater economy in oil resulting from such a change may be tested easily. The 10 users of oil-fired furnaces were selected because they used the same type of furnaces as mentioned in the inquiry. If the scrap brass mentioned is red brass, the performance of the furnaces is good, as 3 gallons of oil per hundredweight of metal melted is good practice. It is not uncommon for 3¼ gallons to be used, especially in crucible furnaces.

Using preheated air is supposed to save from 10 to 15 per cent of the fuel and one maker of such furnaces gives the oil consumption as ranging from 1½ to 2½ gallons per hundredweight of metal melted. This range covers the different alloys, one containing 40 per cent zinc will melt more easily than an alloy running 80 per cent and upward of copper. The figures given in the inquiry are excellent for red metals, and good for yellow brass, in fact most founders would feel skeptical about a figure of 2.22 gallons per hundred of metal for any metal except yellow brass of high zinc content.

Use Sodium Flux for Iron

Method for Purifying and Desulphurizing Molten Iron in Cupola Furnace and Ladle by Special Flux Is Tested in Cleveland Shop—Two Sodium Salts Used

SINCE the earliest times in the iron and steel industry, the action of the element sulphur has been considered detrimental in producing satisfactory material and chemists and metallurgists have made a study of the best ways to eliminate it. The control and elimination of sulphur has been brought about chiefly by the use of fluxes. In desulphurizing molten iron or steel the effect of the slag is proportional not only to its basicity but, in an almost equal degree, to its fluidity. Therefore, one of the objects in desulphurizing is to take full advantage of this effect by using slag-forming materials that will produce a high state of fluidity at the lower range of temperature at which iron and steel are handled in the molten condition. Fluidity is highly essential.

FIG. 2—GENERAL VIEW OF ONE OF THE BAYS OF THE TAYLOR AND BOGGIS FOUNDRY

In the past, lime has been used as the principal desulphurizing material for molten iron and steel. However, it has the disadvantage of forming a viscous or pasty slag so that in treating molten iron or steel, the desulphurizing influence of increased lime is counteracted by its viscosity. This renders the slag less active as a purifying agent and may result in re-sulphurizing the iron or steel due to the greater affinity of sulphur for iron than for calcium at the relatively low temperatures at which the iron melts. The calcium has greater affinity for silicon than for sulphur and, as a result, the lime will first form calcium silicate before forming calcium sulphide and thus reduce the amount of calcium available to remove sulphur. Sodium borate, borax, and boracic acid have been used as flux-forming materials but, while it has been found that these have a strong affinity for the metallic oxides and hold them in solution in the slag, they are of little value as desulphurizers and consequently are limited in commercial use. Potassium salts, sodium nitrate, and magnesium salts,

FIG. 1—THE USUAL MELTING AND POURING CONDITIONS WERE OBSERVED PRIOR TO THE TREATMENT OF THE IRON WITH THE SODIUM FLUX

as well as sodium chloride, also have been used.

Flux carrying sodium as a desulphurizer and purifier, melts at the relatively low temperature of 858 degrees Cent. which is below the melting point of iron. This flux has a low specific gravity and high fluidity which prevent it from being enmeshed in the metal and enable it to rise readily to the top and carry impurities with it. Sodium flux has the further advantage of giving up carbon dioxide freely at the temperature of molten iron and steel and this causes boiling of the molten metal, bringing impurities and injurious gases to the top. The CO_2 is not injurious to the metal, because it is practically an inert gas in the temperature range of molten iron and steel.

The sodium flux does not start to decompose until it reaches the approximate temperature of molten iron and when decomposition occurs, the sodium exists for a brief interval in the nascent state and owing to its great affinity for sulphur, it forms sodium sulphides which are stable compounds. These rise to the surface thereby desulphurizing the metal. So long as there is sodium present and sulphur available in the metal, the greater affinity of the sodium for sulphur than for silicon and phosphorus results in the silicon and phosphorus being left in the metal practically undisturbed.

Further, sodium flux, because of its fluidity and ability readily to separate from the metal and rise to the surface carries with it impurities, such as oxides, which are known to make the metal more sluggish. The sodium salts make the metal more fluid, thus giving the occluded gases better opportunity to escape. This results in reducing blow-holes in the finished casting and permits the use of the cheaper high-sulphur iron and more scrap metal in the melting stock.

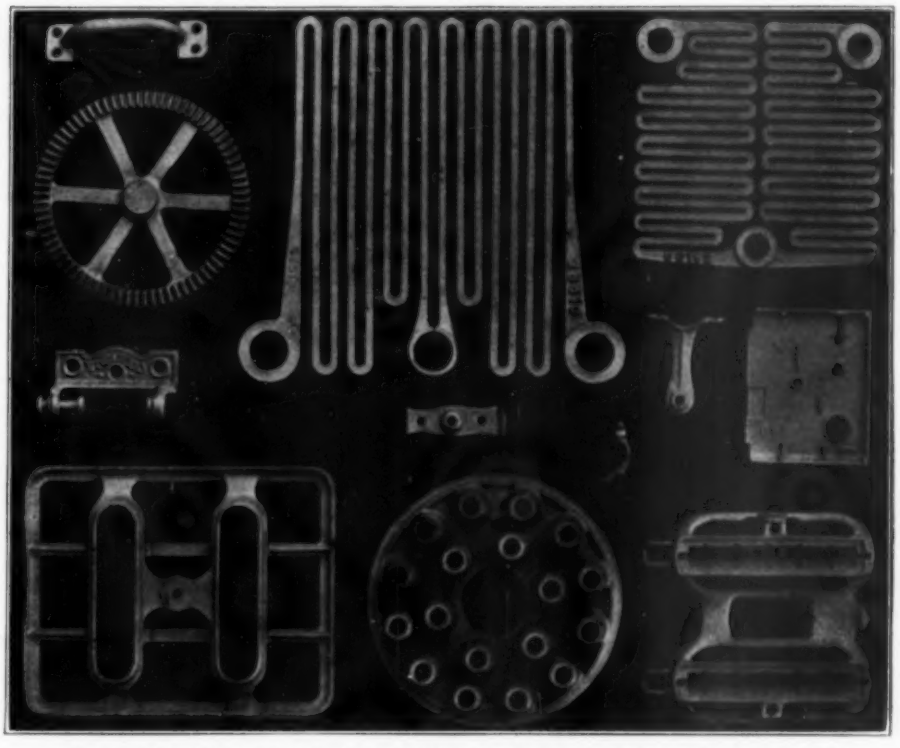


FIG. 4—SAMPLES OF LIGHT CASTINGS POURED FROM TREATED IRON

An interesting test of sodium fluxes was made recently at Taylor & Boggis, Cleveland, to demonstrate the actual amount of sulphur eliminated by using a flux composed of 97 per cent of sodium carbonate and 3 per cent of sodium hydroxide with a catalytic agent, prepared according to a formula devised by Dr. C. T. Hennig, Cleveland. These tests were supervised by Robert R. Snow, foundry superintendent.

The bed charge of iron was made up of 1700 pounds of scrap iron and 300 pounds of foundry pig iron. The object in carrying 85 per cent of scrap was to have as high a sulphur content in the iron as possible for test purposes. Three sets of test bars were prepared, each set consisting of 1 standard test bar 1¼-inch diameter and one, 1-inch square—both bars being 13 inches in length.

The mold designated as *A* received the metal before treatment, *B* received the metal after first treatment, and *C* received the metal after a second treatment. A total of 1500 pounds of the 85 per cent scrap metal was run into a suitable ladle and mold *A* poured with this metal. To the molten metal remaining in the ladle, 7 pounds of the combination sodium flux was added. This was allowed to act on the molten metal covering a period of 5 minutes prior to pouring mold *B*. An addition of 7 pounds of the sodium salts was made allowing a further desulphurizing action to take place covering a period of 20 minutes. After this second treatment, mold *C* was poured.

The molten iron at the end of this second period was hot enough to pour a fair sized casting of ½-inch section. On each addition of the sodium flux vigorous chemical action ensued which previously has been explained.

Chemical and physical tests were made of the three sets of test bars by the James H. Herron Co., engineers and chemists, and the Frank L. Crobaugh Co., analytical chemists, both Cleveland firms. These chemical analyses showed the following results:

	Percentage		
Element	A	B	C
Silicon	2.20	2.16	2.05
Phosphorus	0.286	0.328	0.340
Manganese	0.360	0.370	0.250
Combined carbon	0.650	0.580	0.570
Graphite carbon	2.600	2.750	2.740

After treatment with the sodium flux, the reduction in sulphur of *B* to *A* is

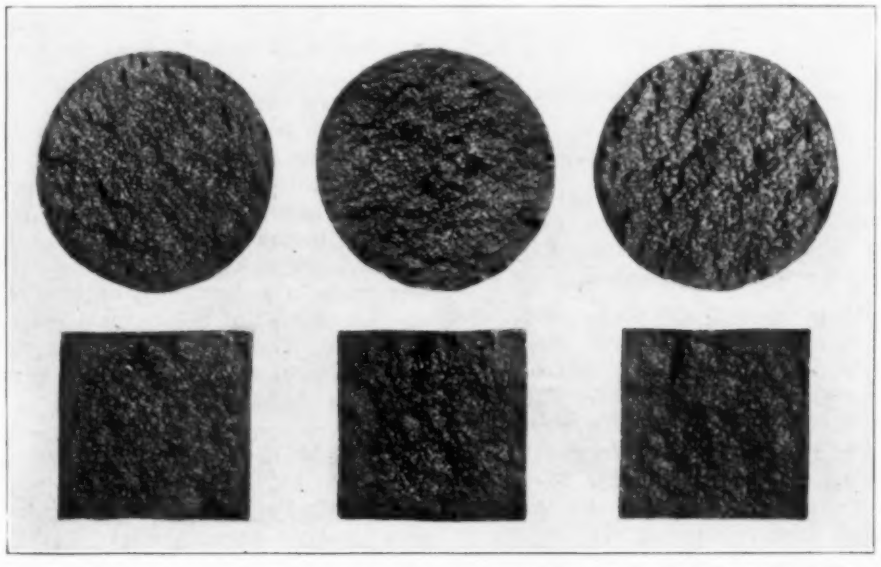


FIG. 3—CROSS SECTION OF TEST BARS SHOWING STRUCTURE OF METAL BEFORE AND AFTER TREATMENT

0.060 per cent and of *C* to *A* 0.068 per cent, the other metalloids remaining practically the same.

The average physical tests of the three 1-inch square test bars were as follows:

	A	B	C
Transverse strength pounds per square inch..	2,268	2,369	2,595

Fig 3 shows cross sections of the three sets of test bars which were used to obtain the physical properties.

Interesting examples of the comparatively light and fragile castings poured from this treated metal is shown in the accompanying illustration, Fig. 4. The casting shown in the lower left corner is a resistance grid approximately 10 x 10 inches, used in electrical installations.

In charging the cupola, the usual practice of first putting in a bed of coke, is followed and, in a case where this initial charge of coke would be about 400 pounds, approximately 4 pounds of the flux should be distributed over the top of the coke bed. As the iron is charged, according to the usual practice, additional flux is thrown in each charge or iron, in the proportion of from 5 to 10 pounds per ton of iron, the exact proportion depending upon the sulphur content of the coke and the iron that is charged and the amount of sulphur that it is desired to reduce.

Toward the end of the melting period the proportion of iron to coke, in the cupola, is relatively low and therefore the iron tends to take up a larger percentage of the sulphur from the coke and to counteract this tendency, it is desirable to increase the proportion of flux in the last two charges about 50 per cent.

While it is preferable to change the sodium flux into the cupola because it has a longer time to react with the sulphur, conditions sometimes arise where the iron appears sluggish as it comes out of the spout of the cupola and it is then desirable to desulphurize in the ladle. Under these conditions the flux either may be put in the bottom of the ladle before the iron is run in, or thrown in when the ladle is about one-quarter full of iron.

On account of the slag thus formed being liquid it is usually advisable to make it more viscous so that it will not run into the mold with the iron. This may be done by adding lime or other relatively infusable material or by blowing a fine spray or film of water over the surface of the slag. When a spray of water is used, it decomposes the sodium sulphide, the sulphur passing off as SO_2 in gaseous form which permits the slag to take up more sulphur from the iron.

Makes Core with Temporary Corebox

BY LAURENCE V. JOHNSTON

AN INTERESTING problem in molding recently was solved in a small shop where the methods used are quite different from those employed in some of the larger foundries of today. Before describing the methods developed in solving this problem it might be well to give a few facts concerning the layout of this small plant. The shop is not over 60 x 60 feet, but the arrangement clearly indicates that the man in charge is familiar with modern foundry methods.

The shop is built of brick with four large sliding double doors. Judging from the rusty appearance the doors have not been moved more than two times a year, once at the approach of the balmy days of spring and again when the sun retreats before the cold winds of the North. The doors admit considerable light and are supplemented by three windows. The cupola is located on the outside of the rear wall to conserve space, as there is no room for it on the inside. The molten iron is delivered by a short spout extending through the wall and protruding several feet into the shop. Air is supplied by a small centrifugal blower located some distance away, the air being conveyed to the tuyeres through terra cotta piping placed under ground. The shop is equipped with a drying oven which opens into the foundry at the side of the cupola. Jobbing castings for ships constitute practically all of the work and this is largely on rush orders.

Some time ago several foundries were asked to bid on a casting similar to a Y-pipe. Since the corebox had been lost, few foundries wanted to attempt the casting. However, the owner of the shop previously described offered a bid on the work and received the order. To build a

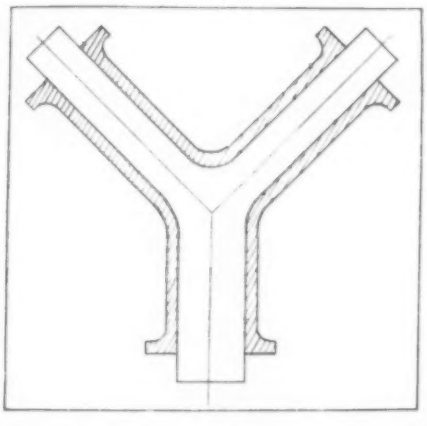


DIAGRAM SHOWING CORE NECESSARY FOR MAKING THE CASTING

corebox would have been expensive, so it was decided to make a substitute or temporary corebox.

Upon receipt of the pattern, the foundrymen first measured the thickness of the pipe to be made, which was found to be 1 inch. The drag half of the pattern was rammed, and after the pattern was drawn the imprints made by the flanges were filled with sand. The impression in the sand then represented the imprint of the pattern without the flanges. The sand in this mold was rammed extremely hard since this was to be used as a corebox.

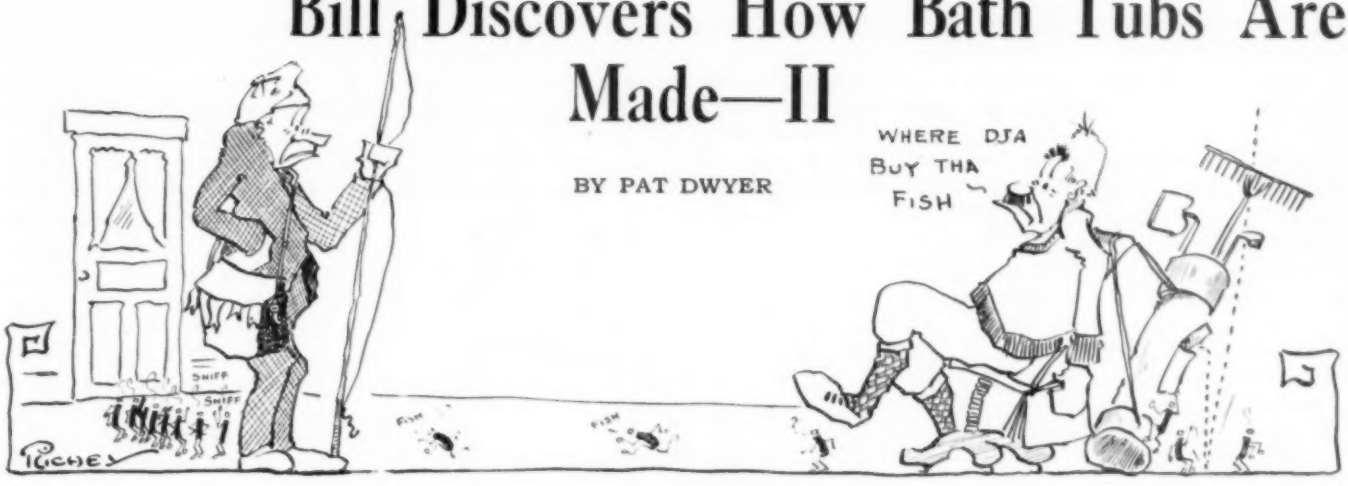
As the metal was to be 1 inch thick, a substance of this thickness placed in the mold would make the mold serviceable as a temporary corebox. It was difficult to find a material for this purpose, due to the irregularity of the pattern, but fire clay was suggested and tried. A frame was made in which the fire clay was formed into a cake 8 x 6 x 1 inch. While still in the plastic state the cake was placed in the mold and carefully pressed back against the surface. The edges of the fire clay lining were trimmed, thus completing a temporary corebox in which half of the core could be made. The clay was allowed to dry thoroughly before the core was made.

Arbors were made for both the cope and drag core as each had to be lifted from the corebox. The cope half had to be turned over and placed on the drag core, this being done after each half had been dried preparatory to being pasted together. With a little touching here and there it was difficult to tell whether the core was made in a permanent or temporary corebox. No trouble was experienced in fitting the core into the mold, and the resulting castings were found to be satisfactory.

S. Davidson Herron, formerly of Pittsburgh but recently affiliated with the A. M. Byers Co. at Chicago, has been appointed district manager at Philadelphia for Hickman, Williams & Co., taking charge of that office and district.

Bill Discovers How Bath Tubs Are Made—II

BY PAT DWYER



ACCORDING to the generally accepted view of the public at large, patience is a wonderful virtue. Some have it in greater degree than others, but it remains an open question in my mind if patience is not just another name for plain, common, old-fashioned laziness. The patience displayed by a cat at a rate hole, or that of a man with a fishing pole waiting for a bite, are illuminating cases in point. Of course, your true fisherman, will claim that the cultivation of patience is one of the most important features in the education of a man who practices the art, but then fishermen are notorious prevaricators and their opinions are subject to a heavy discount. I am not an extremist and would not willingly cast an aspersion on the truthfulness of any fellow human being, but I think I am exercising a reasonable degree of charity when I claim that the statement of any fisherman on any subject may be discounted approximately 94 per cent and then it will contain a few minor errors.

In recent years the golf bug has made serious inroads on the former exclusive preserves of the fisherman and eventually may nose him out of his proud position as the prince of prevaricators. The two forms of recreation have many features in common, but there is an old nautical simile or proverb or something to the effect that a stern chase is a long chase. The fisherman has had a long, long start. These sage reflections were induced in my mind the other night by the fact that I had not seen Bill for more than a week. Usually he drops in for an hour or two several evenings during the week and occasionally I call at his house. I am not an expert visitor and I suppose when the final roll is called I will be found owing several hundred, perhaps thousands, of visits. I am not worrying over a little debt of that character. The debt may be outlawed in the course of time, or any one of a thousand things may happen to cancel it. While there is life there is hope.

Presumably, I might have arrayed myself in the formal garments suitable for visiting and at the expenditure of a trifling amount of time and trouble have found out for myself the cause of his non-appearance. As I said before, patience is a wonderful virtue and I kept putting off the visit from day to day. I found consolation in the reflection that I was merely exercising the good old virtue, although fully aware that some split-hair experts might be inclined to ascribe my action—or lack of action—to pure laziness.

I have no intention of quarreling with the experts. From long experience I have learned that any movement in that direction represents a useless waste of energy. Experts usually are set in their ways and opinions and in addition they seem to have an uncanny faculty of slipping a gleaming point of logic under one's guard.

Call it patience or laziness, don't mind me. If you can extract any pleasure from the admission I am content to let it go as laziness. The net result is the same in either case. I did not visit Bill's house, but bided patiently at home and in due time my patience was rewarded. Bill appeared as usual the other night and without waiting for me to apply the conversational corkscrew he kindly explained the cause of his absence. I was somewhat surprised to learn that he had spent the week in and around New York and other foreign cities and towns in the more or less immediate vicinity of the well known Atlantic ocean.

"Believe me," said Bill, "I had one busy week. When I finally stepped off the train at the 105th Street station in this little town of Cleveland, Ohio, U. S. A. I was fed up with trains and did not care if I never saw one again for the remaining period of my natural life. Enough is enough and then some. Between the long journey down and back, side trips to various points in New Jersey and New York, riding on, above and under the earth in New York City, I did not know half the time whether I was coming or going. In fact at times, to all intents and purposes, I was practically gone. When I finally secured my last ticket and left for home my instinct loudly proclaimed that the train was heading in the wrong direction, although ordinary common sense insisted that I was quite safe in submitting to the superior judgment of the railroad people, at least in this respect. "Every day during the week the sun rose at a point where no self respecting sun should rise and every night the moon shone in a section of the heavens where I firmly was convinced I never had seen it shining before. Plainly I never was cut out for a sailor, a boy scout or a forest runner. Always I have had the greatest admiration for these birds who instinctively can spot the points of the compass in any locality and at

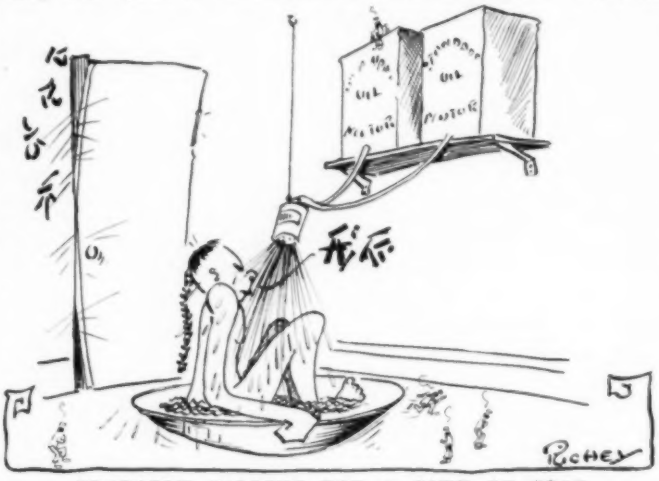
WHEN A FELLER NEEDS A FRIEND

any time during the day or night. In view of my recent experience that admiration now has been changed to a species of reverence. How they do it is a profound mystery. A mystery I probably will carry unsolved to my grave."

"The only point that interests me in this long rigmarole" I said, "Is why did you go on a journey of that character. If you lose your bearings and sense of direction the instant you leave the old homestead, why don't you stay home?" "Well," said Bill, "I'll tell you. "Your question although apparently sincere and as one might say on the level, still smacks of vulgarity to an alarming extent. In fact I almost might say it betrays a nosey disposition and if there is one trait more than another calculated to give me the pip, it is an exhibition of vulgar and idle curiosity. My reason for leaving the vine clad cot and spending a breathless week racing around like a squirrel in a cage is past history which does not concern you in any manner. Do I make myself quite clear? Thank you, my lad. I might have known you would get the correct view point if I gave you sufficient time and favored you perhaps with a kindly word or two of the real old dyed in the wool, genuine, inside information. Now that we have disposed of the point at issue to the satisfaction of all concerned let us take up the thread of our narrative at the point where we laid down our pen and seized our trusty rifle to repel the hostile aborigines in their frenzied rush on the blockhouse.

"During my itinerary—there's a neat word for you now which I picked up in the East—I visited several foundries and was deeply touched by the kindly, in fact I might say cordial reception I was accorded by the men with whom I came in contact. Time, as many a man has said before the idea occurred to me, has a wonderful faculty in changing a man's view point. In one of these places I met a man for whom I had worked about 25 years ago when I was a rambling young molder gaily flitting from one town to another. At the time I had regarded him as an autocratic and arbitrary member of the ruling capitalistic class whose chief aim in life was to grind down the honest face of labor under the iron heel of oppression. When I met him recently I found that he was a kindly, friendly affable old gentleman who laughed heartily when I told him of my former views the while he reluctantly admitted that he had not the faintest recollection of ever having seen me before. Such is life on this world's merry old treadmill.

"However, my most interesting experience was with a man I never had seen before. Through one of these mysterious clan connections which characterizes the Scottish race he is related to the lady who occasionally pokes her inquisitive nose over my shoulder while I am engaged in reading a letter from home—or from any other place. She is an enthusiastic supporter of the old clan spirit and when she learned that I was going east she charged me solemnly to at least pay a courtesy visit and spier 'Hoo's a' wi' ye the nicht?' I spent an exceedingly agreeable night at this man's house in one of the nice little towns in the vicinity of New York and among other things I learned that he had an exceedingly colorful career before he settled down as an electrical contractor in the big city a few years ago.



PROBABLY CALLING FOR A CAKE OF SOAP

"As an electrical engineer in the employment of an American corporation handling foreign business he had installed power plant equipment in the interior of China, in Central and South America, in New and Old Mexico and in several of the western states. The majority of the jobs were in connection with the mining industry which included in many instances the related industries of transportation and smelting.

"He was not what you might call a talkative guy, at least not on that part of his life although ready enough to discuss current events. He admitted that he liked the work and the opportunity to go foraying into the far parts of the earth, but it was no job for a married man and after he had done his bit with the rank of lieutenant in the navy during the recent war he had decided to marry and settle down in a civilized community where he could raise a family in peace. In this respect he has made an excellent start with a little girl and a pair of twin boys already to his credit.

"For a time I was puzzled to account for a haunting feeling that he resembled some person I knew but I could not place my mental finger on the individual. The following day I paid a visit to the Metropolitan Museum of Art and then the mystery was cleared up when I gazed on a picture of the *Return of Ulysses*. The deep set eyes, the straight nose, the determined mouth and the powerful figure bending the terrible war bow that could not be wielded by any other man in Ithaca, might have been modeled from the man I met the night before. When I compared his travels in strange lands and among strange people with the Grecian hero's wanderings for 20 years in search of the Golden Fleece, the parallel was complete. One thing the lad told me reminded me of the subject of bathtubs, a subject which you probably remember I touched upon the last time I was here. His early training had induced a habit of keeping his body clean and the problem of keeping up the good old habit was one of the most serious with which he was confronted in the outlandish places where he earned his daily bread in the sweat of his brow and all that jolly old kind of piffle.

"For example up in the interior of China he found that the natives thriftily employed empty oil cans provided by providence personified by the Standard Oil Co., for a variety of uses never contemplated in the original scheme of things. Practically the only form of exercise from which they were exempt was as a substitute for the one time familiar pitcher and basin. Here is where the resourceful lad demonstrated that the dominant white race usually has an ace up its sleeve thereby throwing a slight aspersion on the familiar quotation 'For ways that are dark and for tricks that are vain the Heathen Chinee is peculiar.'

"He mounted a pair of cans on a shelf about 8 feet above the floor and when he had attached a bit of hose terminating in a tomato can with the bottom punched full of small openings, he had a shower bath outfit equal in all respects, with the single exception of outward appearance, to the flossiest outfit ever displayed in a show window.

"Naturally the problem confronting a modern bathtub manufacturer differs in many respects from that of the pilgrim in a far land who felt the need of sluicing himself down occasionally. The items of time, cost and method were only of secondary consideration to the man who set up the tin can bath. He had no competition and he had no jeal-

ous rivals ready to point a jeering finger at his product. The modern manufacturer in a civilized community engaged in this line of business has to cotend with all the foregoing factors and then a few more that are thrown in for good measure and for the purpose of keeping his mind on the job and his nose on the grindstone.

"The production of bathtubs is a specialized branch of the foundry business and is one that has been brought to a comparatively high state of perfection. By that I do not mean that the scrap loss is negligible, for it is a long and perilous journey from the cupola through the mold, the shakeout, the sandblast and the enameling department where the casting is subjected to the strain of being raised again to a red heat before the enamel is applied. What I do mean is that methods and equipment have been developed to a point where a great deal of the hazard incident to depending on the skill of the operator has been eliminated.

"Bathtub castings are held closely to weight and therefore the manner in which the sand is rammed is of paramount importance. The metal in the casting must be held accurately to a uniform thickness throughout, otherwise the casting will crack during the alternate heating and cooling incident to the enameling process. This factor involves the use of metal flasks machined on the joints and equipped with suitable and substantial guides to insure the correct assembling of the cope on the drag. Cast iron flasks have been used for many years and have given eminently satisfactory service. Within recent years fabricated steel flasks have been introduced to a considerable extent in many bathtub foundries, but so far as I have noted they are only used on plain tubs. The flask used on an apron tub is cut on the ends to follow the peculiar shape of the parting line on the pattern.

"Both cope and drag are equipped with a trunnion at each end by which the flasks are lifted and rolled by the crane. The trunnions on the drag are arranged at points that represent the ends of a horizontal center of gravity line. This feature facilitates the rolling of the drag after it has been rammed full of sand. The trunnions on the cope are set slightly above and a little to one side of a similar imaginary line drawn through the center. The cope is not rolled over, but it is lifted away from the drag at a slight angle so that the body of sand in the hanging pocket will clear the slight indentations in the side of the pattern. In some foundries the cope is suspended from the crane and lowered back on the drag after the pattern has been removed. In others a special device centering around a hoist operated by hydraulic or pneumatic force, is utilized for closing the molds.

"After the drag is finished, it is placed on this device where it is automatically located in the proper position and tipped to the required angle. The cope then is taken from the stand on which it rested while undergoing minor repairs and is placed on the four upright plungers. Suitable horns or plugs on the sides of the cope flask engage the uprights in a manner that tips the cope to an angle corresponding with that of the drag. By releasing a valve at the side the plungers slowly descend carrying the cope with them. Long guide pins on the drag engage the cope while it is still a considerable distance above the drag and guide the drag safely and accurately into place.

"The corner tub with an apron on one end in addition to the apron on the side is made practically in the same manner. The drag and cope are adjusted on the closing fixture accurately and tipped at a previously determined compound angle. The process may seem involved but really after the flasks have been prepared and fitted properly, the actual operation of making the molds is simplified to an extent that justifies the employment of handymen. A special perforated bar suspended rigidly from the cope and supplemented by a number of light gaggers, serves to carry the hanging pocket of sand between the apron plate and the adjoining wall of the tub."

"You have left a few points still unexplained" I said, "But in view of the manner in which you replied when I asked you about your trip down east, I hesitate to trespass. You remind me of the classic reply made by the highland lassie tripping along in her bare feet. A tourist met her and was so astonished at the sight of a woman in her bare feet that he stopped her and said; 'Ah! Tell me my good woman, does every person around here walk out in their bare feet?"

"'No me good man' said she, 'Some of them do and the rest of them mind their own business.'"

Book Review

Standard Electrical Dictionary, by T. O'Connor Sloane, 785 pages, 4½ x 7 inches, published by the Norman W. Henley Publishing Co., New York, and furnished by THE FOUNDRY, Cleveland, for $5.00 net.

This reference book or encylopedia on the science of electricity has been enlarged and several additions made in the new edition. The volume contains full and complete definitions of terms used in the field of electrical engineering and descriptions and illustrations of electrical appliances and connections. The definitions are well worded and may be understood easily by the nontechnical student.

The work is divided into three parts, the first giving the definitions of terms. The second part treats all recent advances in appliances, new developments and refinements in theory, etc. A large number of definitions are included which are required because of the increase of terminology of the science. The third part is devoted to definitions of radio terms.

Synonyms are given and reference to other words and phrases are made. The book contains 786 pages, 493 illustrations and definitions of about 6000 distinct words, terms and phrases. The arrangement of the book is convenient.

THEIR POSITIONS ARE REVERSED BUT THE GENTLEMEN APPEAR TO BE STILL DISCUSSING THE SAME SUBJECT

Dowel Pins Hold Pattern Parts

Various Types of Pins Are Used To Hold the Parts in the Proper Place—Care Must Be Taken in Locating Pins in Wood—Gray Iron and Malleable Iron Dowel Pins Used in Heavy Work

BY WALTER C. EWALT

DOWEL pins, made of wood or metal, are employed by the patternmaker to keep the different loose parts of the pattern or core box in their correct positions. Pins constructed of wood cost the least and are used on patterns where only a small number of castings are required. When used for large numbers of castings, the moisture of the mold often causes the wooden pins to swell and at the same time the hole in the pattern into which the pin fits becomes smaller. The molder then trims the pin off with a file or knife, and since he guesses at the size wanted, the pin probably is made too small, thus causing the pattern to shift and often resulting in a spoiled casting.

If wooden dowel pins are used, they may be made with a dowel cutter, or may be bought in sizes from 3/16 to 1-inch in 3-foot lengths. Brass pins are serviceable where small pins are required since they do not corrode and they are light, strong and close fitting. They may be bought in various sizes and are made in two styles, namely in the plate and threaded.

The pins made in the plate are stamped either round or oblong and are interchangeable with other pins of the same kind. The round type, shown in Fig. 1, is made for heavy patterns the pin being 1-inch in diameter. The obolng type, shown in Fig. 4, is made in the following sizes.

No.	Length	Width	Size of pin
1	1	1/2	5/16
2	1 1/4	1/2	3/8
3	1 1/2	5/8	7/16
4	2	3/4	1/2
5	2 1/2	3/4	9/16

The peg and tube dowels, shown in Fig. 2 are driven into the wood with a hammer, as is the peg or tube dowel shown in Fig. 3 which is improved with the addition of a shoulder. The threads on this dowel do not advance as in a screw but are ridges which

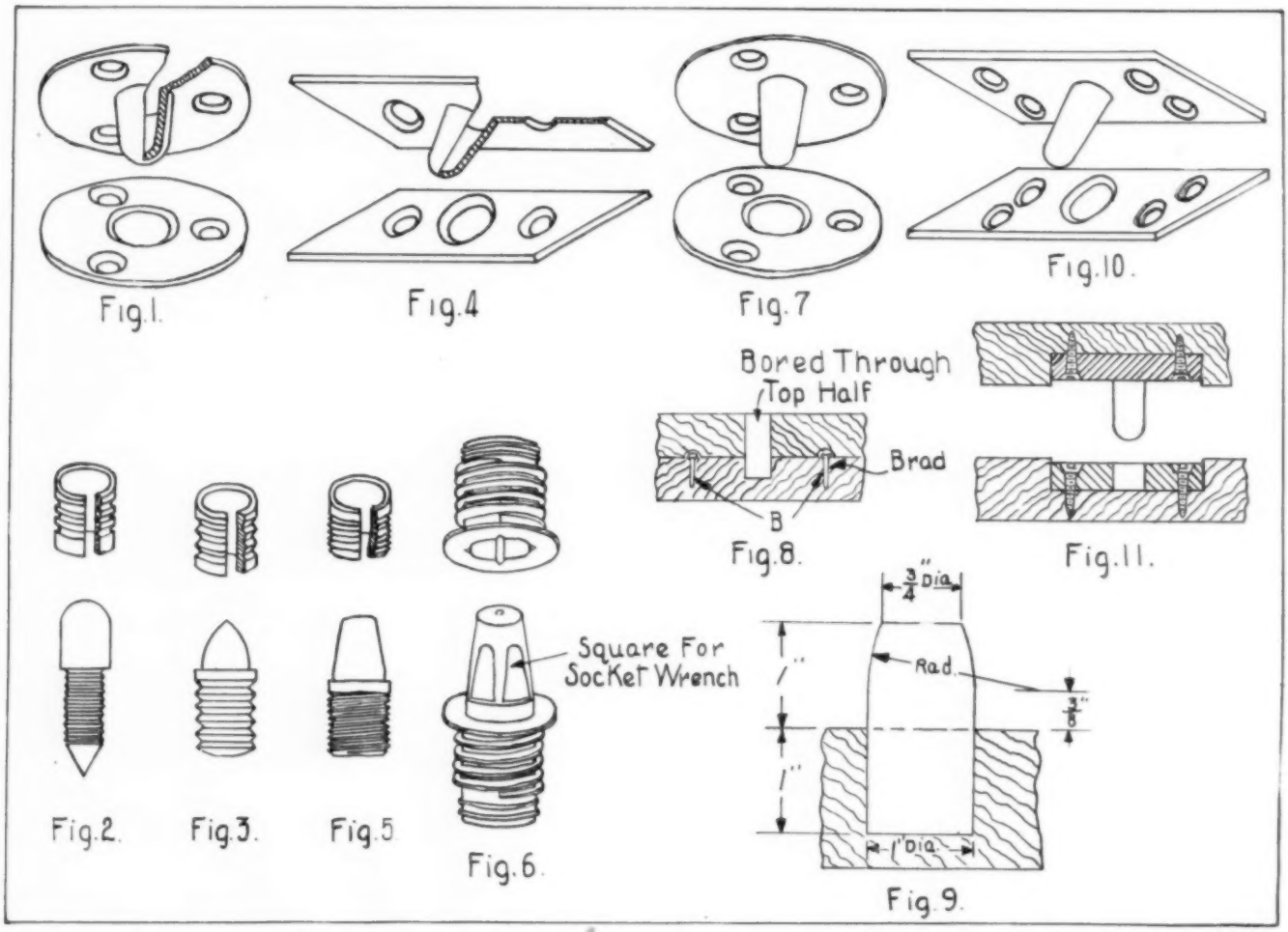


FIG. 1—ROUND DOWEL FOR HEAVY PATTERNS FIG. 2—PEG AND TUBE DOWEL FOR DRIVING INTO WOOD FIG. 3—PEG AND TUBE DOWEL WITH SHOULDER ADDED FIG. 4—OBLONG TYPE FOR HEAVY PATTERNS FIG. 5—REGULAR SCREW THREADS SLIGHTLY TAPERED FIG. 6—FURTHER IMPROVED BY ADDITION OF FLANGE FIG. 7—DOWEL FOR HEAVY WORK FIG. 8—A HOLE MAY BE BORED THROUGH THE TOP TO FIT THE DOWEL FIG. 9—A ONE-INCH DOWEL PIN FIG. 10—OBLONG TYPE WHICH COMES IN VARIOUS SIZES FIG. 11—THE PLATE IS SET BELOW THE SURFACE OF THE WOOD

hold it after being forced into the wood by first boring a hole 1/32-inch smaller than the outside diameter of the threads. Fig. 5 shows a dowel with regular screw threads slightly tapered towards the end by which it may be screwed into the wood. Still more improvement is shown in Fig. 6 where a flange is added. These dowels are screwed in with a special wrench, one end fitting the socket part and the other the pin part. The flange prevents the dowel from being forced too far into the wood, as might be the case with the dowels shown in Fig. 2, 3 and 5 with continual striking of the pin part on the side of the hole in the socket. If the dowel shown in Fig. 6 becomes loose through continual use, it may be tightened easily with a wrench. This dowel also may be taken out and used over again and is considered one of the best tyes to use. In soft wood the flange may be drawn down flush with the surface of the wood, but in hard woods, such as cherry, a sufficient amount of wood must be cut away to allow for the thickness of the flange.

The dowels discussed in this article are manufactured in a number of sizes. The type shown in Fig. 2 is made in diameters of ⅛, 3/16, ¼, and 5/16 inches. The dowel illustrated in Fig. 3 is made with diameters of ⅛, 3/10, ¼, 5/16, ½, ⅝, and ¾. The type shown in Fig. 5 is made in the following size and numbers:

No	Size of pin
1	1/8
1 1/2	3/16
2	1/4
3	5/16
3 1/2	3/8
4	7/16
5	1/2

The following dimensions apply to the dowel shown in Fig. 6:

No.	Diameter of Flange	Diameter of pin	Size of bit in pine	Size of bit in cherry
2	3/8	5/32	1/4	17/64
3	7/16	7/32	5/16	21/64
4	5/8	5/16	7/16	29/64
5	3/4	7/16	9/16	37/64

Gray iron and malleable iron dowel pins may be used for heavy work, the pins ranging from ¼ to 1-inch in diameter. Pins made of malleable iron are good since they are strong and will stand rough usage. The patterns for these may be made 4 or 6 on a gate. When the castings are received they are filed or machined to a good fit. These dowel pins also may be purchased on the market.

Various methods may be followed in locating the dowel pins in the two halves of the pattern or corebox. Holes may be bored from the top through one half of the pattern, as shown in Fig. 8, and the hole at the surface plugged after the dowel pin is located. The pins also may be located by driving small brads, shown in Fig. 8, in one half of the pattern where the dowel pins will be wanted. The heads of the nails are allowed to project 1/16-inch and the other half of the pattern or box is pressed on top of the heads leaving an impression in the wood. The nails then are removed and the holes bored for the dowel pins in the places marked. This method leaves the surface unmarred. The holes also may be laid out, care being taken to get the lines correct. The screw holes should be arranged so that they do not come in the same grain of the wood to prevent splitting.

The plate dowel pins may be located by setting one of the two parts in place. The part is placed on the wood and marked around the outside. The wood is chiseled out until the plate is 1/32 below the surface of the wood. This is done to make sure that the two halves of the pattern or box will come together in case some sand sticks to the pin and falls down on the plate. This method of placing the dowel pins is illustrated in Fig. 11. When one half of the dowel is fastened to one half of the pattern or box, the remaining part of the pattern is placed on top of the dowel and the pattern struck with a mallet thus making an impression in the wood. A better way is to cover the back of the dowel with heavy shellac and to place the top of the pattern on the back of the shellacked dowel and to allow it to rest there until stuck. The half pattern may be lifted off bringing the dowel with it. It may then be marked and the dowel set. It should be remembered that the pin part of dowels always is put on the cope upper, part of the flask since the molder ,when making the mold, places the drag on the board and the pins must not be in the way. When inserting the socket part in a corebox, a hole in the inside diameter of the dowel is bored through the wood so that the coremaker may push out any sand that collects in the hole. If a wood dowel or a pattern for and iron dowel is made, the pins should be left long enough so that when one half of the core box is lifted from the other, the pins will guide it and there will be no danger of striking the sand sideways. Fig. 11 shows a 1-inch dowel pin. The proportions may be applied to any size with good results, using either wood or metal. 11 illustrations to go

Faked Foundry Facts

Pellows

Smooth Casting Surface

Question: We operate a modern foundry equipped with American molding machines for making light castings for optical and electrical instruments in gray iron. The castings are satisfactory in every respect with the exception that the skin is not perfectly smooth. We shall appreciate any suggestion on how to secure castings that will present a more attractive appearance.

Answer: A fine, smooth surface on castings is secured by making the molds in a fine grade of sand and then dusting the faces of the molds with blacking. The castings afterward are cleaned in a tumbling barrel which imparts a polish to the exterior. We are not familiar with the sand employed in the foundries of your country, but in America the sand used for light castings is known as Albank No. 0 or 00 or its equivalent.

Of the 119 establishments engaged in the manufacture of aluminum castings bars, plates, ware, etc., reporting for 1923, 27 were located in Ohio, 14 in Wisconsin, 12 in Michigan, 11 in New York, 9 in Illinois, 7 in New Jersey, 6 each in Indiana, Massachusetts, and Pennsylvania, 5 in California, and the remaining 16 in Colorado, Connecticut, Iowa, Minnesota, Missouri, Nebraska, Rhode Island, Tennessee, Washington.

Foundrymen Meet At Paris

Papers Are Contributed by Several Foreign Associations—Meeting To Be Held in Liege, Belgium in 1925—Committee Is Appointed To Study Pattern Standardization

OVER 30 papers were read and discussed at the fourth congress of the Association Technique de Fonderie de France held at Paris, Nov. 21 to Nov. 23 at the Conservatoire National des Arts et Metiers under the patronage of the French government. Subjects for consideration were listed under the following headings: Use of special grades of pig iron, scientific and experimental study of foundry sands, defects of castings, standardization of patterns, production costs.

Exchange papers were read from several foreign foundry organizations including the American Foundrymen's association, Institute of British Foundrymen, Association Technique de Fonderie de Belgique. Prominent foundrymen were represented by G. Masson, president of the Belgian association; M. Vanzetti, Italian foundrymen; M. Brasseur, Grand Duchy of Luxembourg; M. Hezy, Switzerland and M. Espana, Spain. V. Delport, European manager, THE FOUNDRY, transmitted the congress the invitation of the American Foundrymen's association to attend the international congress scheduled to take place in the United States in 1926.

At the first session, eight papers prepared by engineers of the new foundry school which opened in Paris this year were read and discussed. At present over 20 students are following the courses of the Ecole Superieure de Fonderie.

At the session devoted to the study of special grades of pig iron M. Lamberton stated that most of the tonnage used in France comes from foreign sources. As a result of a letter sent to electric furnace operators it is apparent that a considerable tonnage of this material can be produced in France. Test pieces taken from castings made from French materials have shown a tensile strength of approximately 36,000 pounds per square inch. The author stated that the use of a mixer would eliminate any lack of homogeneousness sometimes found in a car load of special grades. M. Brull, professor at the Ecole Centrale des Arts et Manufactures and at the foundry school doubted the advantages of the mixer. He also said that the manganese should not exceed 0.50 per cent and the phosphorus should not exceed 0.06 per cent.

That the chaaracteristics of a casting do not depend only on its analysis, but also on the state of the component elements and the manner in which they are distributed was claimed by A. Campion, Glasgow, Scotland who prepared the exchange paper contributed by the Institution of British Foundrymen.

E. Ronceray, managing director Bonvillain and Ronceray, Paris, who read the paper stated that in his opinion the primary requisite in a casting is it's soundness followed by lack of internal stresses and by the resistance or strength of the casting. The test piece does not necessarily indicate the strength and in certain cases sound castings have been obtained from pig iron containing up to 2.00 per cent sulphur. Reheating a casting to a temperature of approximately 500 degrees Cent., eliminates the internal stresses without diminishing the strength.

Discusses Special Pig Iron

M. Roehrich, commercial manager Union des Consommateurs des Produits Metallurgiques et Industriels described special grades of pig iron made by the furnaces of Hagondange, Lorraine, with ore containing up to 0.11 per cent phosphorus. Jacques Varlet, foundry manager Societie Anonyme Metallurgique d' Esperance-Longdoz, Seraing, Belgium read a paper on the physical properties of special grades of pig iron in which he stated that the pig iron produced up to 1900 in small furnaces with cold blast was of a higher grade than the product of today. Pig iron of special grades now produced often are not homogeneous. The author presented a classification of special pig irons with their chemical and physical properties and made special mention of semisteel which he considers as an artificial grade of pig iron.

M. Buffet, Societie Alsacienne said that good semisteel could be obtained with as much as 35 per cent steel. The important features to observe are the proportion of total carbon and silicon, also the temperature of the mold and the thickness of the casting. He referred to the pearlitic cast iron produced in Germany and emphasized the fact that the conduct of operation is of the greatest importance. M. Varlet said that he does not favor the use of semisteel for friction parts.

A paper on the use of the X-ray in detecting interior defects in castings was presented by M. Juppeau, general inspector of public education who officially represented the French government.

A summary of the work already done relating to the properties of natural molding sands was presented by R. P. Lemoine, professor at the Ecole Superieure de Fonderie. This paper was followed by several others dealing with related phases of the same subject. The subject matter of the papers and the discussion which followed paralleled closely the manner in which the same subject was handled at the convention of the American Foundrymen's association in Milwaukee and which was covered fully in the post convention issue of THE FOUNDRY, Nov. 1.

The annual exchange paper prepared by R. F. Harrington, W. L. McComb and A. Hosmer, Hunt-Spiller Manufacturing Co., Boston and contributed by the American Foundrymen's association was read by E. Ronceray. In the discussion which followed it was pointed out that great care should be taken not to confuse porosity with permeability. Good sand contains from 2.00 to 4.00 per cent iron oxide although the statement frequently is made that it should contain none. A method of rapidly separating the argillaceous substances from the siliceous and colloidal substances was described in which the work was done by agitating the sand in a tube containing hydrochloric acid, benzine and water. A. Tauflieb in referring to the paper presented by B. Hanley and C. W. Holmes at the 1923 foundry congress in Paris claimed that the practical foundry in the majority of cases needed a less complicated method. He described a method which he has devised for arriving at satisfactory conclusions without the services of a chemist or a laboratory.

A. Debar, inspector at the Ecole Superieure de Fonderie presented a paper on the study of defects in castings. Defects broadly may be classified under the following heads: Defects due to pattern, to the mold, to the method of melting, to the metal itself and to the cleaning methods. Recommendation was made that scrapped castings should be examined carefully as a base on which to devise precautionary meas-

(*Concluded on Page* 995)

Collecting Medals Is His Specialty

ENRIQUE TOUCEDA whose glittering eye in the accompanying photographic representation is reminiscent of the late Mr. Coleridge's ancient mariner, you know the guy who shot Albert Ross with a bow-and-arrow, might have been a haughty don or hidalgo lording it on horseback under the shade of a silver mounted sombrero if he had remained in Cuba where he was born in the year of our Lord, 1866.

Fortunately for the malleable iron industry he left his native land while still a boy in his early teens and attended Georgetown college for four years. At the close of that period, deliberately ignoring Horace Greely's advice to go West, young man, go West, he traveled in a generally northern direction until he arrived at Troy. Not the famous city where Helen was putting on her vamping sketch before crowded houses for seven years, but the hilly town on the bank of the Hudson river in the well known state of New York.

After the fashion of many boys before and since and without any definite object in view he rambled into Rensselaer Polytechnic institute and finding it to his liking he decided to stick around for a few years and lap up whatever measure of knowledge could be acquired without too much exertion or without interfering to any serious extent with his other and more important activities.

He completed the prescribed course of instruction in 1887, being then as you may note for yourself by referring to the opening paragraph exactly 21 years of age. One of two inferences may be drawn from this statement. Either the course of studies prescribed in those days was much simpler than corresponding courses in later years, or our hero kept his eye on the ball most of the time. Be that as it may the fact remains that at the age of 21 he was granted a diploma testifying to all and sundry—in the event that they were interested—that he now was a duly qualified civil engineer. He was told politely, but firmly, that the time had come for him to go out and wrest a living from the wild and wicked world and incidentally stand prepared to give three of those rousing cheers for the old alma mater on every appropriate occasion. The selection of occasion was left to his own innate sense of propriety, but no penalty was attached to the exercise of generosity.

History does not state that he graduated at the head of his class or that he required the service of a porter to carry home the medals, but he has made up amply for this oversight—if any—in recent years when he has annexed many medals of various kinds including the John A. Penton medal awarded for conspicuous service in the foundry industry. This signal mark of merit was conferred upon him at the recent convention of the American Foundrymen's association held in Milwaukee.

After graduation he entered the service of the Troy Steel & Iron Co. This plant was built by the eminent engineer Alexander Holley and was one of the first to operate under the patents of Sir Henry Bessemer. Here his bent for research gradually superseded the effects of his education as a civil engineer and he was advanced from one position to another until he became chief chemist and metallurgist.

While in the service of this and other companies for a period of several years he carried on a consulting practice along metallurgical lines. In 1898 he opened an office in Albany, N. Y., and went into business for himself as a consulting metallurgical engineer. A few years later he was appointed professor of metallurgy at Rensselaer Polytechnic institute and he still delivers lectures at that seat of learning in addition to his many other activities.

Actuated by a laudable desire to produce castings of a high and uniform quality, castings that would appeal to customers and reflect credit on the manufacturer, the American Malleable Castings association in 1912 secured the services of Professor Touceda and turned him loose on the problem. The result has been highly satisfactory and of mutual benefit to both the party of the first and the party of the second part. The professor has accumulated a national reputation as an authority on malleable foundry practice and the American Malleable Castings association points with pride to a class of castings that was not considered within the range of possibility 15 years ago.

For example, at one time malleable foundrymen congratulated themselves when their castings met the British admiralty specifications of 40,000 pounds tensile strength per square inch and with a 5 per cent elongation in 2 inches. At present the castings made in the shops of the association *must* show a tensile strength of at least 50,000 pounds per square inch and a 10 per cent elongation in 2 inches.

Last year Professor Touceda presented the American annual A. F. A. exchange paper before the Institute of British Foundrymen at Birmingham. He is a member of the American Society of Civil Engineers, American Institute of Mining and Metallurgical Engineers, Society Automotive Engineers, American Society for Testing Materials, American Iron and Steel institute, British Iron and Steel institute, American Society for Steel Treating, American Foundrymen's association, American Chemical Society and an honorary member of the Institute of British Foundrymen. His work on various committees of technical societies has been extensive and valuable. He is vice chairman of the iron and steel committee American Institute Mining and Metallurgical Engineers, chairman malleable iron committee American Foundrymen's association and is a member of the committee on ferrous metals advisory to the bureau of standards. Up to the present he has registered no complaint of finding time hanging heavy on his hands or wondered what he is going to do next.

THE FOUNDRY

Registered U. S. Patent Office

A semimonthly journal devoted to all branches of the foundry trade

Published by
THE PENTON PUBLISHING CO., CLEVELAND, O.

BRANCH OFFICES

BOSTON.....426 Old South Bldg.
CHICAGO.....1147 People's Gas Bldg.
CINCINNATI.....406 Edwards Bldg.
NEW YORK.....2203-2206 No. 220 Broadway
PITTSBURGH.....2148-49 Oliver Bldg.
SAN FRANCISCO.....675 Monadnock Bldg.
WASHINGTON, D. C.....84 Home Life Bldg.

FOREIGN OFFICES

BIRMINGHAM, ENGLAND.....Prince's Chambers
LONDON, ENGLAND, 2-3 Caxton House, Westminster, S.W.1
PARIS FRANCE.....23 Rue de la Bienfaisance VIIIe
Cable address, IROTRAPEN, London

SUBSCRIPTION

United States and Mexico.....$3.00 a year
Canada.....$4.00 a year
Great Britain and other Foreign Countries.....£1:0:0 a year
Single Copies.....25 cents
Copies published three months or more previous to date of current issue, 50 cents each

ADVERTISING

All communications relating to advertising copy, discontinuances, etc., must be received on the 1st and 15th of the month preceding date of publication.

Member, the Audit Bureau of Circulations, Associated Business Papers, Inc., and National Publishers Association
Entered at the Post Office at Cleveland as Second Class Matter

Copyright 1924 by The Penton Publishing Co.

Contents

	Page
Makes Machine Tool Castings	957
Fluorine Reacts Upon Refractories	962
Trace History of 121 Years Service	963
Plan Malleable Plant	963
Making Manganese Steel	964
Refining Metals Electrically	967
Equipment Speeds Output	971
Linseed Oil Is Employed as a Core Binder	977
Describes Bell Founding—III	978
Shrinkage Usually May Be Traced to Iron	979
Melting Bronzes in Electric Furnaces	980
How and Why in Brass Founding	981
Gating Stick Brass	981
Defective Bushing	981
Fuel Consumption of Furnace Good	981
Use Sodium Flux for Iron	982
Makes Core with Temporary Core Box	984
Bill Discovers How Bath Tubs Are Made—II	985
Book Review	987
Dowel Pins Hold Pattern Parts	988
Foundrymen Meet at Paris	990
Collecting Medals Is His Specialty	991
Seeking Opportunity Pays Dividends—Editorial	992
Nonferrous Production Increases—Editorial	992
Trade Outlook in the Foundry Industry	993
Personal	994
English Making More Aluminum Castings	994
Obituary	994
Bell Founder Dies at Watervliet, N. Y.	944
Gives Foreign Practice	995
Make Personnel Changes	995
Plan Exhibition	995
British Iron Research Association Meets	995
Book Review	995
Purchase Molding Machines	996
Expects Buying Movement in January	996
What the Foundries are Doing	997
New Trade Publications	778

Seeking Opportunity Pays Dividends

A FEW years ago a western gray iron foundry originated a miniature model of a familiar type of taxicab. Clever design and the application of two colors of paint made this toy so attractive that it practically sold itself. Probably the increase in melt due to the successful sale of this novelty did not amount to a large tonnage, but a profitable, easily made foundry commodity such as this proved to be might prove valuable, particularly during dull times.

The increasing interest in pecans, grown for years in the southern and western states induced a foundry in Texas to devise a nut cracker designed on the principle of a screw press. This consists of a frame in which a screw, propelled by twisting a handle set at right angles to the screw shaft, drives a cross head, set on a universal joint, against a nut placed in the frame casting. The entire device, smaller than a man's hand, proved popular, particularly when mail orders were solicited through advertising and the entire country became familiar with the tasty southern pecan. The cracker provided some gray iron foundry with a continuous source of demand.

These instances, while insignificant in themselves offer suggestion to the foundryman sufficiently alive to opportunities that may be cultivated. An hour's trip through any of the popular five and 10 cent stores is an education in the importance of small things and the wide uses of castings in low priced necessities.

Nonferrous Production Increases

FIGURES issued recently by the department of commerce show that the value of products of establishments engaged primarily in the manufacture of brass, bronze and other nonferrous alloys or from copper was greater than for any previous year in which a census of manufacturers was taken. The total output from plants of this type for the year 1923 was valued at $511,470,131 as compared with $214,903,735 in 1921, the last census year, representing a gain of 138 per cent over 1921 when the general business depression gripped the country. The values of nonferrous products in 1909 was $149,989,058, in 1914 $162,199,019 and in 1919, $482,312,790, the latter representing an increase of 221 per cent over the total for 1909. While a loss of 55 per cent was registered in 1921 compared with 1919, a complete recovery was realized in 1923, the value of the products for that year showing a gain of 241 per cent over 1909.

Production of brass, bronze, copper and other nonferrous metal and alloy castings in 1923 also showed an increase, although not commensurate with that developed in some other products. In 1923, 300,376,420 pounds of castings valued at $71,970,574 were produced as compared with 245,536,906 pounds in 1921 valued at $57,880,218, the tonnage increase being 23 per cent. More brass, bronze and copper castings were produced in 1923, the totals for that year being brass, 148,667,834 pounds, bronze, 125,432,082 pounds and copper 7,777,462 pounds. However, castings of other nonferrous metals and white metal alloys were not poured in as great a quantity as in 1921, 18,499,042 pounds being produced in 1923 as compared with 34,632,582 pounds in 1921. An interesting feature of the casting production is the fact that the percentage increase in tonnage and in the value of the products practically are the same, indicating that little change in price has taken place in the past two years.

Trade Outlook in the Foundry Industry

WAITING at the station with steam up seems to characterize many industrial lines at the closing of 1924. Everyone seems confident of a quick pickup after the first of the year, inquiries indicate a large potential demand, but the universal desire to close on the evening of Dec. 31 with as low an inventory as possible has held back buying of many manufactured commodities and has prevented greater industrial activity during the last of November and the first weeks of December. The effect of this tendency doubtless will be intensified buying on rush order immediately after Jan. 1. The waiting policy is too general to result otherwise.

Buying Subsides

Immediately after the election, a buying movement in pig iron was started which went forward with a sweep that brought to the furnaces bookings aggregating 1,500,000 tons. This huge demand measured by the production for October would keep the furnaces reported as active on the last of that month busy for the first three months of the year. A great part of this buying was confined to steel works, but foundry buyers where represented, particularly the larger users. Northern iron sales have continued into early December, but many representatives of the southern furnaces report that buying has subsided to wait the coming of the new year. Producers of nonferrous metals noticed a buying movement in November, which has slackened. Many report that brass foundries, notably the plumbing goods shops, have orders on their books awaiting only the release from jobbers to start intensive operation. Sales of refractories, and particularly silica brick have been heavy during the late fall, but have slowed appreciably in the past few weeks.

Prices for Raw Materials for Foundry Use

CORRECTED TO DEC. 6

Iron		Scrap	
No. 2 foundry, Valley	$20.00 to 22.00	Heavy melting steel, Valley	$19.50 to 20.50
No. 2 southern, Birmingham	19.00 to 20.00	Heavy melting steel, Pitts.	20.50 to 21.00
No. 2 foundry, Chicago	21.50 to 22.00	Heavy melting steel, Chicago	18.00 to 18.50
No. 2 foundry, Philadelphia	23.63 to 23.76	Stove plate, Chicago	15.00 to 15.50
No. 2 foundry, Buffalo	22.50 to 23.00	No. 1 cast, Chicago	20.00 to 20.50
Basic, Valley	20.00 to 21.00	No. 1 cast, Philadelphia	18.50 to 19.00
Basic Buffalo	22.00 to 22.50	No. 1 cast, Birmingham	15.00 to 15.50
Malleable, Chicago	21.50 to 22.00	No. 1 cast, Buffalo	17.00 to 18.00
Malleable, Buffalo	22.50 to 23.00	Car wheels, iron, Pittsburgh	20.00 to 20.50
Coke		Car wheels, iron, Chicago	19.50 to 20.00
Connellsville foundry, coke	$4.25 to 4.75	Railroad malleable, Chicago	20.25 to 20.75
Wise County foundry, coke	4.50 to 5.00	Agricultural mal., Chicago	18.25 to 18.75
		Malleable, Buffalo	20.00 to 20.50

Production Sustained

Production of all grades of pig iron made a decided gain in November according to statistics compiled by the *Iron Trade Review*. The total is given as 2,531,247 tons for November, compared with 2,461,727 tons for October giving a gain of 51,520 tons, although the past month was one day shorter than its predecessor. On a daily average basis, the output was at the rate of 83,775 tons per day for November compared with 79,410 tons per day for October, giving an increase of 4365 tons a day or 5.5 per cent. The comparison of merchant iron production is not so favorable for November. During the past month a total of 606,230 tons of merchant grades was produced, while the preceding period of 31 days recorded 607,717 tons. However, on a daily basis, the average output for November was 20,208 tons, giving a gain of 605 tons per day over the October daily average make of 19,603 tons. During the past month, 24 furnaces were blown in and 3 were blown out, giving a net increase of 21 furnaces for the month. A total of 203 furnaces were in production on the last day of November, which is practically half of the country's capacity. The total number of blast furnaces is given as 411. The merchant stacks showed a net gain of 3 for November.

Foundry Operations

Foundry activity is increasing, slowly, but steadily. One malleable manufacturer describes the condition as healthy convalescence with signs of an early recovery. According to the department of commerce, October showed orders for 54,589 tons of malleable castings secured by 140 plants with a joint capacity of 114,264 tons. The orders represent 43.8 per cent of capacity. A comparison made on the basis of 119 identical plants reporting continuously since October 1923 gives a better indication of the improvement in malleable castings lines. October showed orders received to be 44.2 per cent of capacity, while September was 37.2 per cent, August 32.7 per cent and July, the low point was only 28.4 per cent. Enamel sanitary ware, according to the department of commerce, has encountered a lull. The orders received for bath tubs during October totaled 77,361 against shipments 93,875, and with unfilled orders of 79,444. Lavatories showed 93,415 orders and 105,497 units shipped while sinks and miscellaneous items registered a similar decrease in demand. This condition is ascribed to the reluctance of jobbers to increase their inventories prior to the first of the year. Jobbing foundries making gray iron castings report varied fortunes. Automobile cylinder demand increased in the early part of December. Eastern gray iron shops are increasing operations, those in the vicinity of New York City reporting their rate as 55 per cent of capacity. The Ohio Foundrymen's association reports operations for October showing a satisfactory increase. That month showed the actual melt to be 64.5 per cent of capacity.

Nonferrous Active

Brass foundries note improved inquiry, but little actual business closed. This is true particularly of shops making bushings, railway brasses, etc. A foundry in northern Ohio is booked practically to capacity on copper tuyeres for blast furnaces. New York nonferrous prices, according to the *Daily Metal Trade* of Dec. 6, follow: Casting copper, 13.75c; electrolytic copper, 14.05c; lead, 9.00c to 9.12½c; Straits tin, 55.12½c; antimony, 14.50c; nickel, 33.00c; aluminum, No. 12 remelt, 22.00c to 22.50c. Zinc is 6.95c to 7.00c, E. St. Louis, Ill. Average monthly prices for November follow:

New York Prices

Castings Copper	Electrolytic Copper	Lead	Tin Straits	Antimony	Aluminum 98-99	Zinc St. Louis
13.363	13.878	9.083	54.256	14.151	27.00	6.794

Personal

JAMES BROWN, vice president in charge of manufacturing of Thos. E. Wilson & Co., Chicago, has acquired control of the Standard Foundry & Mfg. Co., DeKalb, Ill., and becomes president of it, Jan. 1. Mr. Brown formerly was in the cutlery department of Standart Bros., Detroit, and later was superintendent of production for Miller Bros., Meriden, Conn. The present line of the Standard company, which has one gray iron cupola, is furnaces and furnace castings, and will be continued, with heavy hardware specialties in addition. The Standard Company was founded in 1906.

Charles A. McCarthy, assistant foundry superintendent of the Worthington Steam Pump Corp., Blake & Knowles Works, East Cambridge, Mass., spoke at a meeting of the New England Foundrymen's association, held in Boston, Dec. 10 on "Practical Foundry Molding Problems."

Charles Piez, chairman of the board of directors of the Link-Belt Co., Chicago, and president of the Nugent Steel Castings Co., Chicago, has been nominated for president of the Illinois Manufacturers' association.

Jacob Keuster, foundry superintendent of the Deutz Gas Motor Co., Cologne-Deutz, Germany, is making a tour of this country visiting foundries.

English Making More Aluminum Castings

"Aluminum Castings" was the subject of a lecture by C. Dicken, foundry manager, Humber Ltd., Coventry, England, before the Birmingham branch of the Institute of British Foundrymen at a meeting held at Dudley, Nov. 15. A feature of the talk was a description of a series of alloys in general use and extensively employed in the automobile industry. Slides showed the handling of castings and appliances used in the foundry.

The speaker emphasizes the growing use of aluminum, stating that brassfounders in many instances also are making aluminum castings since this metal frequently is replacing brass. Its use is growing, not only in the field of the airplane and automobile, but for domestic and electrical purposes. Aluminum seldom is used in the pure state, the elongation being too high and the tensile strength too low. Much general use has been made of the air board L5 alloy consisting of 2 to 3 per cent copper, 12 to 14 per cent zinc and the remainder aluminum. This is used largely for making crank cases, gear boxes, rear axles, etc., having a tensile strength of 20,000 pounds sand cast and 28,000 pounds chill cast with an elongation of 6 per cent sand cast and 4 per cent chill cast. Another alloy largely used for motor cycle crank cases, gear boxes, etc., consists of 92 per cent aluminum and 8 per cent copper, having a tensile strength of 22,000 pounds per square inch and 3 per cent elongation. L11, an alloy containing 7 to 8 per cent copper, 1 to 2 per cent zinc and the remainder aluminum, resists a fairly high

JAMES BROWN

temperature and is suitable for cylinders or any castings having to stand stress combined with temperature. L8, comprising 88 per cent aluminum and 12 per cent copper, is known universally as a piston alloy and is suitable for castings produced in a permanent mold where elongation is not required. The tensile strength is about 20,000 pounds per square inch. A useful alloy is one containing 5 to 13 per cent silicon and the remainder aluminum, which helps to overcome difficulties connected with porosity. The speaker warned users against the wide variety of aluminum scrap. Stress was laid on the use of the pyrometer, as excessively hot metal causes many wasters. He considered 700 degrees Cent. the best for most testing. Cores should be released from the casting as soon as possible. An ordinary mixture of red and black sand fairly tough is a suitable sand for molds, and the best results are obtained with 91 per cent of sand, 9 per cent of water, the mold being faced with an equal percentage of graphite and French chalk. Blowholes are caused by the failure of gases to escape, an excessive proportion of moisture or ramming the molds too hard.

Obituary

W. Lucien Scaife, aged 71, a former manufacturer of Pittsburgh, died in his home in that city Dec. 3. He was formerly chairman of the board of directors of the Scaife Foundry & Machine Co., Pittsburgh, and was one of the first trustees of Carnegie Institute of Technology. He was also on the board of the Carnegie Hero Fund commission, secretary of the Educational Fund commission, and a director of the University of Pittsburgh. Six years ago Mr. Scaife retired from active business and gave most of his time to philanthropic and educational endeavors. He was born in the old Fourth street road in what is now the Sixth ward. After receiving his elementary education in the public schools of this city, he entered Yale university and graduated in 1873. He then went to Germany and attended the Frieberg University School of Mines. At the completion of his course he spent several years in the mining business in Nova Scotia. Mr. Scaife was a member of the Duquesne club and the Alliance Francaise.

Bell Founder Dies at Watervliet, N. Y.

Andrew Henry Meneely, for many years a noted authority on bells and head of the bell making establishment Meneely & Co., Watervliet, N. Y., died at his home in that city Nov. 28 after an illness of only a few weeks at the age of 68. The late Mr. Meneely was a grandson of Andrew Meneely who first established the business in 1826. Originally bells were only a side line to the manufacture of mathematical and surveying instruments, but gradually the founding of bells became the more important factor in the conduct of the establishment and eventually became the only product. In 1874 Mr. Meneely began his apprenticeship under the direction of his father and uncle, both eminent craftsmen, and studied the fundamentals of a calling in which later he was to be an acknowledged authority. When his uncle retired in 1876 the young man was given added responsibility and was admitted into partnership with his father in 1880. Six years later upon the death of his father he assumed complete charge of the business and retained his supervision until within a few weeks of his death.

During his long and active career he brought the technique of bell making to a high state of perfection. Through an extensive series of tests

and investigations carried on between 1890 and 1895 he made the important discovery that the tone elements of bells could be determined accurately in advance by the aid of specially designed instruments and that such bells when intended for musical sets, could be musically harmonized in themselves and with each other by mechanical processes and methods of testing.

He is survived by a widow and eight children, Mrs. Henry Graton Gould, North Crafton, Mass.; Ernest Andrew, Watervliet, N. Y.; Mrs. R. Rae Harrington, Troy, N. Y.; Lawrence Young, New York; John Kimberly, Coeymans, N. Y.; Alfred Cluett, Watervliet, N. Y.; Mrs. Francis Bates Quackenboss, Worcester, Mass.; Mrs. Harold S. Dorrance, Rochester; and one brother George Kimberley Meneely, Antigo, Wis.

Founders Meet at Paris

(*Concluded from Page* 990)

ures. An interesting discussion followed on the use and abuse of chaplets.

In the opinion of P. Devaux, blisters are not always caused by excessive sulphur, but to the method in melting. Other speakers admitted that while some manganese sulphide can be formed, still defects also can be caused by iron oxide.

The exchange paper of the Belgian foundrymen's association on moleclar equilibrium in iron castings presented by Ivan Lamoureux emphasized the danger of using a metal containing an excessive amount of phosphorus.

As a result of the papers and discussion on the subject of pattern standardization it was resolved that a commission be appointed to study the question at greater length. Reference was made to a statement made at the recent convention of the American Foundrymen's association to the effect that $10,000,000 a year is wasted through this item alone. The universal interest taken in the discussion indicated the importance which the foundrymen attach to the subject.

Study of production costs in the foundry was covered in four papers: Contribution to the Study of Production Costs and It's Principles, by J. DeBosgrollier, manager Usines de Mazieres; exchange paper presented by the Belgian foundry association and read by Paul Ropsy; Production Costs and Selling Prices in Foundries, by E. Feron; Supervision of the Exploitation of the Foundry by a Method of Continuous Production Costs.

In the discussion which followed, M. Lely suggested that a semi-official method of figuring costs be devised in certain cases such as the estimation of war losses, etc. Other suggestions included consideration of the factor involved in proper maintenance of the works and machinery and a method of determining a method of figuring production costs based on the hour or on the machine.

In closing the congress Emile Ramas pointed out the importance of the work which had been done and thanked the foreign associations which had contributed their share to make the congress a success. He expressed the hope that the fruitful cooperation would continue. G. Masson extended an invitation to the congress which will be held at Liege, Belgium next year.

Gives Foreign Practice

H. Bornstein, chief chemist, Deere & Co., Moline, Ill., addressed the November meeting of the Quad-City Foundrymen's association at Davenport, Ia., Nov. 20. Mr. Bornstein spent the summer visiting in England, France, Switzerland, Italy and Belgium. His talk dealt with the economic and business conditions in these countries and included a description of foundry practices and costs in some of the plants visited. He mentioned the extensiveness and thoroughness of the apprenticeship courses in Europe and stated that the production cost of articles there is less than in this country, due to the difference in the cost of labor, the cost of raw materials being about the same. In addition to gray iron foundries Mr. Bornstein also mentioned malleable iron and steel practices in Europe.

Make Personnel Changes

C. S. Garland, manager of the coke department of Hickman, Williams & Co., Inc., Pittsburgh, has been removed to the New York office to take charge of that entire office, serving in the capacity of district manager in New York. D. H. Goodrich will succeed Mr. Garland at Pittsburgh.

Plan Exhibition

An exhibition is planned in connection with the annual meeting of the Society of German Foundrymen to be held in 1925 in Dusseldorf. The principal aim of the exhibition will be to show what science in the foundry has done. Manufacturers of equipment will participate and it is probable that castings will be shown.

Of the 64 manufacturers of foundry supplies reporting to the department of commerce for 1923, 19 were located in Ohio, 17 in Pennsylvania, 10 in Illinois, 5 in New York, and the remaining 13 in Alabama, Connecticut, Indiana, Massachusetts, Michigan, Missouri, New Jersey and Virginia.

British Iron Research Association Meets

The third annual meeting of the British Cast Iron Research association was held in London, Eng., Nov. 19, H. B. Weekes presiding in the absence of Lloyd Weir. The membership of the association has increased to 257, and laboratory premises have been acquired in Birmingham for research work and conducting chemical, microscopic heat treatment and mechanical tests. The necessary staff has been engaged. The council had assured the department of science and industrial research that the income for the first 5 years would be sufficient to qualify for the receipt of a full government grant. Numerous lines in which research is progressing were indicated. Sir John Dewrance was elected president for the year, other officers including F. W. Firth, Sheffield, Professor Turner, F. J. Cook and Douglas Vickers.

Book Review

A. S. T. M. Standards, 1219 pages, 6 x 9; published by the American Society for Testing Materials, Philadelphia. For the year 1924 copies of the book are available in cloth binding to members, price $5.00, to nonmembers $8.00. Paper binding to members $4.50, nonmembers $7.00.

This volume contains 220 standard specifications covering carbon and alloy steels, wrought iron, pig iron, cast iron, and finished castings, the nonferrous metals and their alloys, coal, coke and various miscellaneous materials such as linseed oil, turpentine, pigments, clay products, etc.

Standard methods are adopted by the society for the chemical and physical testing of raw materials and finished products which will be a valuable guide to chemists, metallurgists and engineers.

A portion of the volume is devoted to standard methods of metallographic testing of iron, steel, nonferrous metals and alloys with standard rules for the preparation of micrographs of the various metals and alloys with recommended practice for photography as applied to metallography.

The volume is issued triennially. Those standards which are adopted by the society in the intervening years are published in yearly supplements to the book of standards. Before a standard receives the formal approval of the society it is published for one or more years as a tentative standard.

The Philadelphia office of the Clark Tructractor Co., and the Clark Equipment Co. has been moved from 615 Jefferson building to 1023 Widener building. W. M. Oplinger is in charge.

Purchase Molding Machines

Manufacturers of This Line of Foundry Equipment Realize Substantial Gains in Sales—Inquiries Accumulating at Much Better Rate —New Projects Contemplated

SALES of molding machines on a much larger scale than has been realized for several months is the feature of the foundry equipment market for the first part of December. The Beardsley & Piper Co., Chicago, the Herman Pneumatic Machine Co., Zelionople, Pa., and the Stoney Foundry Engineering and Equipment Co., Cleveland, have made numerous sales while other manufacturers of this line of equipment have secured substantial increases in orders. Other branches of the equipment market are feeling the improved conditions, although in not so marked an extent. In Pittsburgh, Cleveland and Western districts, inquiries are being brought out at a much better rate with indications pointing to an early closing on many items. Users appear to be holding off contracts until after the first of the year to keep down plant inventories. General feeling among the trade is healthier than it has been for some time and manufacturers predict a buying movement early in 1925.

Among the foundry construction contemplated are included plants by the Reading Foundry & Supply Co., Pottstown, Pa., the Etna Machine Co., Toledo, the Penn Hardware Co., Reading, Pa., and a core department by the American Radiator Co., Buffalo. The Keystone Bronze Co., Pittsburgh, will rebuild its plant which recently was damaged by fire.

Expect Buying Movement in January

WHILE the foundry equipment market in the Cleveland district is spotty, considerable improvement has been noted during the past two weeks. Manufacturers in several lines report that users are closing on current inquiries, while other builders are realizing little improvement in sales. Inquiries are more plentiful. Equipment manufacturers feel that the business in December will be satisfactory, considering the fact that many plants are taking inventories at this time, and that a decided improvement in sales will come shortly after the first of the year. The Foundry Equipment Co., Cleveland, has sold equipment to the Continental Gin Co., Atlanta, Ga., including a battery of four large car-type mold ovens, two rack type core ovens and two rolling drawer type core ovens together with heavy duty mold cars and steel core racks. The Youngstown Foundry & Machine Co., Youngstown, O., and the Adamson Machine Co., Akron, O., have purchased heating equipment for attachment to core ovens from the Mayor Fuel Saving Furnace Co., Cleveland. The same company has sold three furnaces for attachment to ovens to the Erie Forge Co., Erie, Pa. The American Steel Foundries, East St. Louis, Ill., the Central Foundry Co., Dundalk, Md., the Standard Foundry Co., Racine, Wis., and the Ohio Malleable Iron Co., Columbus, O., have purchased shakeout bails from the Stoney Foundry Engineering & Equipment Co., Cleveland. The American Steel Foundries, the Great Lakes Foundry Co., Port Huron, Mich., the Conemaugh Iron Works Co., Blairsville, Pa., the Pullman Co., Pullman, Ill., the Penn Mold & Mfg. Co., Dover, O., the Ajax Iron Works, Corry, Pa., the Griffin Wheel Co., Detroit, the American Radiator Co., Buffalo, N. Y., and the Worthington Pump & Machinery Co., Elmwood Place, O., have ordered shakeout and vibrator equipment from the Stoney Foundry Engineering & Equipment Co., while the Ferro Foundry & Machine Co., Cleveland, has ordered 24 molding and core machines of various sizes, eight for cylinder molds, two for piston molds, seven for green sand cylinder drag cores and seven for green sand cylinder cope cores, from that company. The Ohio Steel Foundry Co., Springfield, O., has purchased sand blast equipment from the Pangborn Corp., Hagerstown, Md. The Etna Machine Co., Toledo, O., will build a foundry of the latest type of construction on the site of the old plant. The charging floor is being built which includes the locker, wash rooms, and a machinery room. The Penn Hardware Co., Reading, Pa., is erecting a new building at an estimated cost of $61,800 to house its brass molding department. The H. K. Ferguson Co., Cleveland, is the contractor. Repair work is becoming heavy in a number of plants indicating that foundries are preparing for increases in operating capacities in the near future.

Pittsburgh Sales Increase

LATE in November and early this month the movement of foundry equipment in the Pittsburgh area has been greatly accelerated, improved conditions setting in immediately following the presidential election. Numerous inquiries are out which probably will not materialize until early in 1925, users not wishing the new equipment included in this year's inventories. The Mutual Foundry Co., Franklin, Pa., recently took over a plant there and did not have to purchase a cupola or blower. However, it did buy core ovens, tumbling barrels, grinding machines, emery wheels, exhaust fans, dust collector shovels, ladles, etc. A new foundry in Pittsburgh, the Miles Plastic Bronze Co., has purchased a 42-inch oil burning furnace. The Pittsburgh Meter Co., Pittsburgh, also awarded a contract for a brass-working electric furnace to the Detroit Electric Furnace Co., Detroit. An inquiry about to be closed here calls for a 1000-pound brass furnace. The Mesta Machine Co., Pittsburgh, recently purchased a 14-cubic foot sand mixer and bids were opened Dec. 2 on a sand mixer for the government's navy yard at Brooklyn, N. Y. Other inquiries for foundry equipment are current from the government for various navy yards the equipment wanted including about 100 electric tools such as grinders, drills, etc. Railroads recently have been in the market for equipment for their foundry departments, the Pennsylvania wanting eight or nine items for different shops. This railroad recently purchased two worm geared crane ladles for its Altoona, Pa., plant. The Norfolk & Western railroad at Roanoke, Va., purchased a large quantity of flasks, as did the New York Central at Elkhart, Ind. In some directions where equipment needs are pressing inquiries are being issued one day and the orders following immediately on receipt of quotations. The sale of molding machines lately has been heavy, numerous orders and inquiries being in the hands

of various molding machine manufacturers, including the Herman Pneumatic Machine Co., Zelienople, Pa. Formal orders recently received by this manufacturer include one from the Sterling Steel Foundry Co., Braddock, Pa., for nine machines. The American Laundry Machinery Co., Rochester, N. Y., which is equipping a new foundry, also purchased six machines from this direction and the Mt. Vernon Car Mfg. Co., Mt. Vernon, Ill., bought six car wheel machines for its new foundry, and additional orders are to follow. The orders for one machine each came from the Michigan Valve & Foundry Co., Detroit; the Huntzpillar Mfg. Co., Boston; Weil-McLain Co., Michigan City, Ind.; Sawbrook Steel Casting Co., Lockland, O., near Cincinnati; National Brake & Electric Co., Milwaukee; National Cast Iron Pipe & Foundry Co., Birmingham; Dean Bros. Co., Indianapolis; Michigan Steel Castings Co., Detroit, and the Bowler Foundry Co., Cleveland, which bought a large jarring machine. Judging from the number of inquiries for molding machines current, foundries scattered throughout the country are preparing for good business during 1925 and while verbal orders have been received for a number of machines, the confirming orders are scheduled to come through shortly. Among prospective purchasers of foundry equipment are the Keystone Bronze Co., 39th street and Allegheny Valley railroad, Pittsburgh, which recently suffered a fire in its plant and will rebuild. The American Radiator Co., Austin street, Buffalo, plans the erection of a concrete and steel building for a core department and it is possible that additional core ovens will be purchased. Crane and hoist inquiries from foundries are fairly plentiful. Recent contracts booked in this territory include the following: Struthers-Wells Co., Warren, Pa., one 15-ton electric traveling crane with 58-foot span, awarded the Shaw Electric Crane Works, Muskegon, Mich.; Pressed Steel Car Co., McKees Rocks, Pa., a 20-ton 4-motor, 55-foot 10-inch span, foundry ladle crane with 5-ton auxiliary, awarded the Milwaukee Electric Crane & Mfg. Co., Milwaukee; and the Aetna Foundry & Machine Co., Warren, O., one each 3-ton and 10-ton electric traveling crane from the Northern Engineering Works, Detroit.

Eastern Sales Lag

BUYING of foundry equipment in the East continues dull. Notwithstanding a decided improvement in sentiment, there has been no marked increase in either inquiries or orders. The trade generally appears to have reached the point where it looks for little to develop in the way of business until after the holiday and inventory seasons. New construction is negligible, and until after the foundries get more orders on their books, a revival appears out of the question. The improved position of the iron and steel industry generally, it is believed, will be reflected in the foundry branch shortly, and foundrymen and equipment sellers alike are optimistic over the prospects for next year. The Sweet & Doyle Foundry & Machine Co., Troy, N. Y., has purchased sand-blast and dust arrester equipment from the Pangborn Corp., Hagerstown, Md., as has the Allen Mfg. Co., Nashville, Tenn. Included in the few new projects under contemplation at this time is a $100,000 addition for the Reading Foundry & Supply Co., Pottstown, Pa. Albert MacGregor, 1628 Vine street, Philadelphia, is contractor in charge. While there has been some disposition among supplymen to shade prices, this situation has given way to one of strength. Equipment prices have been steady, and recently the tendency has been upward. There has been a little improvement in demand for snap flasks.

More Inquiries Out

SEVERAL lists of foundry equipment are out for quotations, but actual orders against these are not expected to be placed until after the first of the year. Foundry activity continues to increase gradually despite the season, and the long period of dullness in the equipment trade argues well for fairly lively business early in the year. Several textile machine manufacturers are inquiring for molding machines. A Connecticut hardware manufacturer wants sand blast equipment. Inquiry is reported covering three small cranes for Massachusetts foundries.

Western Sales Increase

RESISTANCE to the installation of new equipment on the part of foundries of all types has been decreasing in the past fortnight and manufacturers in the Chicago district have become greatly heartened. The Beardsley & Piper Co., Chicago, has placed a tractor type sand throwing machine in each of the following plants: Union Radiator Corp., Johnstown, Pa.; General Electric Co., Lynn, Mass.; Grand Rapids Malleable Works, Grand Rapids, Mich.; Conemaugh Iron Works Co., Latrobe, Pa., and Waterloo Gas Engine Co., Waterloo, Ia. It has placed portable type sand throwing machines in the plants of the American Rolling Mill Co., Ashland, Ky., Bethlehem Foundry & Machine Co., Bethlehem, Pa., Walworth Mfg. Co., Kewanee, Ill., and Centre Foundry & Machine Co., Wheeling, W. Va. Repeat orders for the stationary type of sand throwing machine have been received from the Standard Sanitary Mfg. Co. and Columbia Sanitary Mfg. Co., Louisville, Ky., and the Lycoming Mfg. Co., Williamsport, Pa. The National Engineering Co., Chicago, has placed its sand mixing machines in the foundries of the Erie Malleable Iron Co., Erie, Pa., the New York Air Brakes Co., Watertown, N. Y., and the Terre Haute Malleable & Mfg. Co., Terre Haute, Ind. Among the sales of the Pangborn Corp., Hagerstown, Md., are included dust arrester equipment to the Kay-Brunner Steel Castings Co., Los Angeles, sand-blast equipment to the Packard Motor Car Co., Detroit and the Benton Harbor Malleable Foundry Co., Benton Harbor, Mich., and sand-blast and dust arrester equipment to Dodge Bros., Detroit.

What the Foundries Are Doing

Activities of the Gray Iron, Malleable, Steel and Brass Shops

Kilby Car & Foundry Co., Anniston, Ala., plans reconstructing a foundry building recently damaged by fire.

Die Castings Co., Ninth street, Philadelphia, has awarded contracts for 1-story, 60x150-foot plant.

American Laundry Machinery Co., Sherer street, Rochester, N. Y., plans reconstructing its plant recently damaged by fire. John Strobel, 622 E & B building, is architect and engineer.

The General Die Casting Co., has awarded a contract for the erection of a 60x150-foot plant at Reading, Pa., to the Baton Construction Co., Inc., 1317 Sansom street, Philadelphia.

Isabell-Porter Co., Richmond, Va., has been incorporated with $400,000 capitalization to own and operate iron foundries. Brainerd Avery is secretary of the company.

Highland Park Die Casting Co., Highland Park, Mich., has been incorporated for $100,000 to manufacture aluminum castings, by H. D. Rice, D. Sanders and J. Carrier, Detroit.

New London Ship & Engine Co., Groton, Conn., operator of gray iron, steel, brass and aluminum foundries, plans constructing a fabricating shop enabling it to enter business on full construction

Southwark Foundry & Machine Co., Philadelphia, has awarded contracts to the Truscon Steel Co., 1505 Race street, that city, for an addition to its tool room at Fifth and Washington streets.

Dynbal Co., New York, has been organized with $50,000 capital, to manufacture grinding machines and tools, by F. H. Butehorn, F. C. Taylor and H. B. Holland, with F. J. Knorr, Albany, N. Y., as attorney.

Skelly Oil Co., Tulsa, Okla., plans constructing tank car repair shop for which foundry and forge shop equipment will be needed. C. C. Herndon, Unity building, is vice president and general manager.

Lucey Mfg. Corp. of Texas, Hill and Burnett streets, Houston, Tex., was damaged badly by fire recently with heavy loss to molding room, machine shop and foundry. The company manufactured oil well tools and equipment.

B. Hoffman Mfg. Co., 1809 St. Paul avenue, Milwaukee, plans constructing 1-story, 57x110-foot plant addition for the manufacture of valves and iron pipe. The company operates gray iron, brass and aluminum foundries.

Kahlenberg Bros. Mfg. Co., Two Rivers, Wis., manufacturer of marine and oil engines, plans constructing a foundry and machine shop addition. An architect has not yet been selected and work probably will not proceed until Feb. 1.

The Royal Brass Mfg. Co., Cleveland, C. W. Brennan, general manager, is in the market for a core oven, a medium size sprue cutter and pit melting furnaces, preferably used equipment.

H. W. Caldwell & Son Co., Western avenue and Seventeenth street, Chicago, subsidiary of the Link-Belt Co., has awarded contracts to Chris Rasmussen, 77 West Washington street for new structure. Frank D. Chase, Inc., 720 North Michigan avenue, is architect.

Hammond Foundry Co., Hammond, Ind., has been incorporated with $60,000 capital, to do a general foundry and machine shop business by A. E. Kays, William Cappel, Otto Knoerzer, J. A. Manuszak, B. M. Surdijk, S. A. Bell and J. W. Weis.

Ellison Brass Mfg. Co., Inc., Falconer, N. Y., has awarded contracts to Mullen, Guinnane & Ludwig, 927 Monroe avenue, Jamestown, N. Y., for constructing 1-story, 50x120-foot foundry on Main street. The company operates a brass and aluminum foundry.

United States Cast Iron Pipe Co., Burlington, N. J., plans constructing foundry building at Twenty-seventh and Boyce streets, Chattanooga, Tenn. This is in addition to the plant under construction in Burlington, as reported in THE FOUNDRY, Dec. 1.

Walker Mfg. Co., Racine, Wis., is constructing a 1-story, 100x180-foot plant of brick and concrete. Charles O. Johnson, 224 LaFayette avenue, is general contractor. W. T. Walker is president of the Walker company which operates a malleable foundry.

Peerless Foundry Co., Indianapolis, Ind., has awarded contracts to W. A. Sides, 121 Harfield avenue, for 1-story, 30x40x70x123-foot foundry addition, at 1853 Ludlow street, that city. T. J. Cornwell is general manager of the Peerless company which operates a gray iron foundry.

Flint Malleable Casting Co., 318 Dayton building, Flint, Mich., has retained Wright & Nice, Flint Coal Co., building, as architects and engineers for 1-story, 140x380-foot brick and concrete temporary foundry and office building. J. Barringer is manager of the Flint company.

Lieberman & Gittlem Metal Co., 60 Pleasant street southeast, Grand Rapids, Mich., has awarded contracts to P. R. Barnes, 1836 Linden southeast, to construct 1-story, 40x120-foot brick foundry and office building. H. D. McEachron, Association of Commerce building, is architect.

General Metal Bed Co., 816 Clinton street, Hoboken, N. J., has awarded contracts to the H. K. Ferguson Co., Cleveland, for constructing a 135x140-foot, $40,000 foundry addition American Radiator Co., 1 Austin street, Buffalo, N. Y., is planning construction of a core building.

Chicago Faucet Co., 2712 North Crawford avenue, Chicago, has awarded contracts to A. Lund Co., 19 South La Salle street, for 2-story side addition to its plant. The company operates a brass foundry and machine shop. Wolf, Sexton, Harper & Trueax, 7 West Madison street, are architects. *Noted Nov.* 15.

International Harvester Co., 606 South Michigan avenue, Chicago, has retained the Austin Co., 160 North La Salle street, Chicago, as engineer for a 1-story, 80x500-foot brick and steel frame building to be constructed in Fort Wayne, Ind. W. D. Price is chief engineer of the International company.

Wabi Iron Works, Welland, Ont., was damaged by fire which started in the boiler room and spread throughout the molding and machine shops at its plant in New Liskeard, Ont. It is expected that the plant will be rebuilt immediately. The company operates gray iron, brass and aluminum foundries.

Reading Foundry & Supply Co., Reading, Pa., has awarded contracts to Albert MacGregor, 1628 Vine street, Philadelphia, for constructing 1-story, 75x150-foot plant costing approximately $100,000 at Pottstown, Pa. John G. Fleck, president of Fleck Bros., 50 North Fifth street, Philadelphia, is in charge of the construction. *Noted Dec.* 1.

Standard Sanitary Mfg. Co., Bessemer building, Pittsburgh, has awarded contracts for constructing 5-story, 75x158-foot plant on Fifth avenue, Baltimore. The company operates gray iron foundries at New Brighton, Pa., Louisville, Ky., and Toronto, Ont. R. A. Groah Construction Co., 317 North street, Pittsburgh, is general contractor.

Bain-Beaird Co., Shreveport, La., has taken over the Empire Steel Construction Co. in Cedar Grove suburb there and will make extensive plant improvements including installation of a new foundry and machine shop, etc. The company specializes in fabrication of structural and sheet steel and repairs tank cars. J. B. Beaird is general superintendent.

New Trade Publications

EXHAUST FANS—Motor-driven fans for the purpose of exhausting air from buildings form the subject of a bulletin by the Diehl Mfg. Co., Elizabeth, N. J. Data are given for the various sizes and types of fans to aid in determining the best for specific installations.

FILTERS—Necessity for clean water and the means of obtaining it by filtration are presented in a handsomely illustrated catalog by Wm. B. Scaife & Sons Co., Oakmont, Pa. Much information as to impurities present in water and the means of removing are given.

TEMPERATURE CONTROL—Necessity for automatic control of temperature when gas and oil are used as fuel is presented in a bulletin by F. J. Ryan & Co., Philadelphia. Six types of control apparatus for control of these fuels are described and illustrated.

METAL COATINGS—Spraying a coating of molten metal on metallic surfaces is the subject of a bulletin by the Metals Coating Co. of America, Philadelphia. The method and apparatus are described and halftones present a wide variety of uses for metallic coatings.

MECHANICAL STOKERS—Unusual in that it presents a complete catalog of the various competitive manufacturers of mechanical stokers, a book just issued by the Stoker Manufacturers association. It is an illustration of the value of co-operative advertising.

RECUPERATOR FURNACES—A folder describing furnaces for nonferrous metals has been issued by the Combustion Engineering Corp., New York, covering recuperator furnaces for melting brass and other metals, particularly a small two-pot furnace designed for smaller foundries.

GRINDING WHEELS—Factors affecting the selection of grinding wheels are set forth at some length in a booklet by the Norton Co., Worcester, Mass. After a discussion of the various factors governing the use of wheels a table is given as a guide to the selection of the proper wheel for each operation.

BRASS—Uses and methods of manufacture of various brass alloys are given in a booklet by the Scovill Mfg. Co., Waterbury, Conn. Modern methods are contrasted with the rule-of-thumb operation of the past and many questions that may have puzzled the buyer are made clear.

ILLUMINATED SWITCHES—By a process of depositing aluminum on the metal of the switch case the Mutual Electric & Machine Co., Detroit, has produced a finish which gives a high reflection in presence of a slight illumination and reveals the location of the switch. The device is illustrated and described in a bulletin.

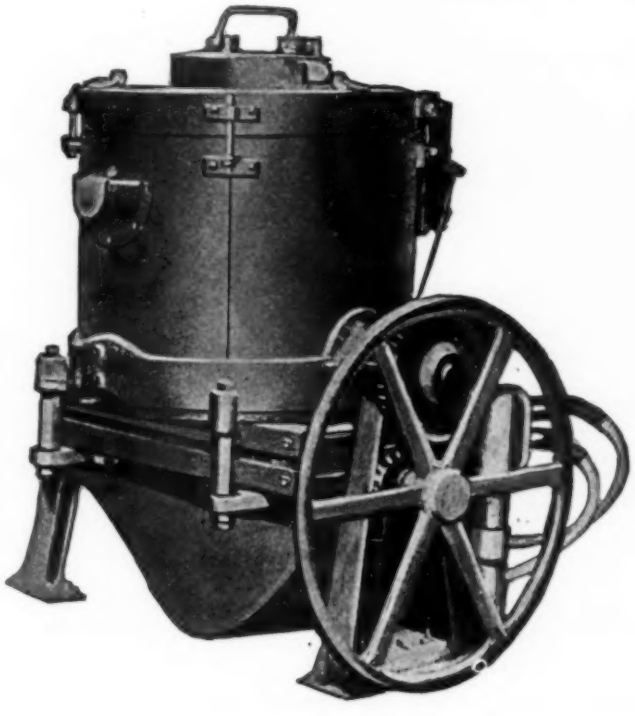
FOUNDRY PRACTICE—A pocket-size booklet of 16 pages has been prepared by the Hillside Fluor Spar Mines, Chicago, which is being sent to foundrymen. It includes a wealth of suggestions as to methods for obtaining good results in casting. Methods of figuring the heat and dependable analyses for various kinds of castings are supplied.

WELDING ELECTRODE—In a booklet of 12 pages the General Electric Co., Schenectady, N. Y., tells of its electrode designed for welding use. Results of tests on welded cast iron specimens and deposited metal are given. Oscillograms showing arc stability are reproduced. Specifications for standard sizes are given as well as instructions for use of the electrode.

AUTOMATIC ROTARY FURNACES—Continuous heat treatment and annealing of articles permitting of slow rolling action and continuous stream movement form the subject of a profusely illustrated booklet by the W. S. Rockwell Co., New York. Uniform temperature and time of treatment in the furnaces are obtained by automatic devices. Numerous installations are illustrated.

STOKERS—Automatic supply of fuel in steam boilers has become so much a part of modern industrial practice that the type of the stoker is the important factor in an installation. The combustion Engineering Corp., New York, describes its single retort underfeed stoker in a 24-page booklet. Many illustrations make clear the construction and operation of the device.

STEEL FOR ELECTRICAL USES—The history, manufacture and magnetic properties of electrical sheet steels and ingot iron are presented in a well-illustrated booklet by the American Rolling Mill Co., Middletown, O. An interesting chapter traces the development of magnetic material for use in generators and motors. Graphs are used to make comparisons and halftones assist in making clear many of the processes.



One of the greatest sources of expense in the brass foundry has been the cost and maintenance of crucibles. The life of even the best crucible depends on careful handling, and with high labor turn-over this is difficult to obtain.

Since the advent of the Ajax-Wyatt Electric Furnace in the yellow brass field, you can banish this daily worry and expense *because the Ajax-Wyatt needs no crucibles.*

The average life of the best crucibles is limited, even with the best of care.

The average lining life of the Ajax-Wyatt Electric Furnace is 1,500,000 pounds and in several cases the lining has lasted well over 6,000,000 pounds.

This is only one economy of the Ajax-Wyatt Electric Furnace — a catalog describing the rest is yours for the asking.

THE AJAX METAL COMPANY

Established 1880

PHILADELPHIA

NEW YORK **BOSTON**
CHICAGO **CLEVELAND**

Also manufacturers of Ajax Process Brass and Bronze Ingot Metals

AJAX-WYATT ELECTRIC FURNACES

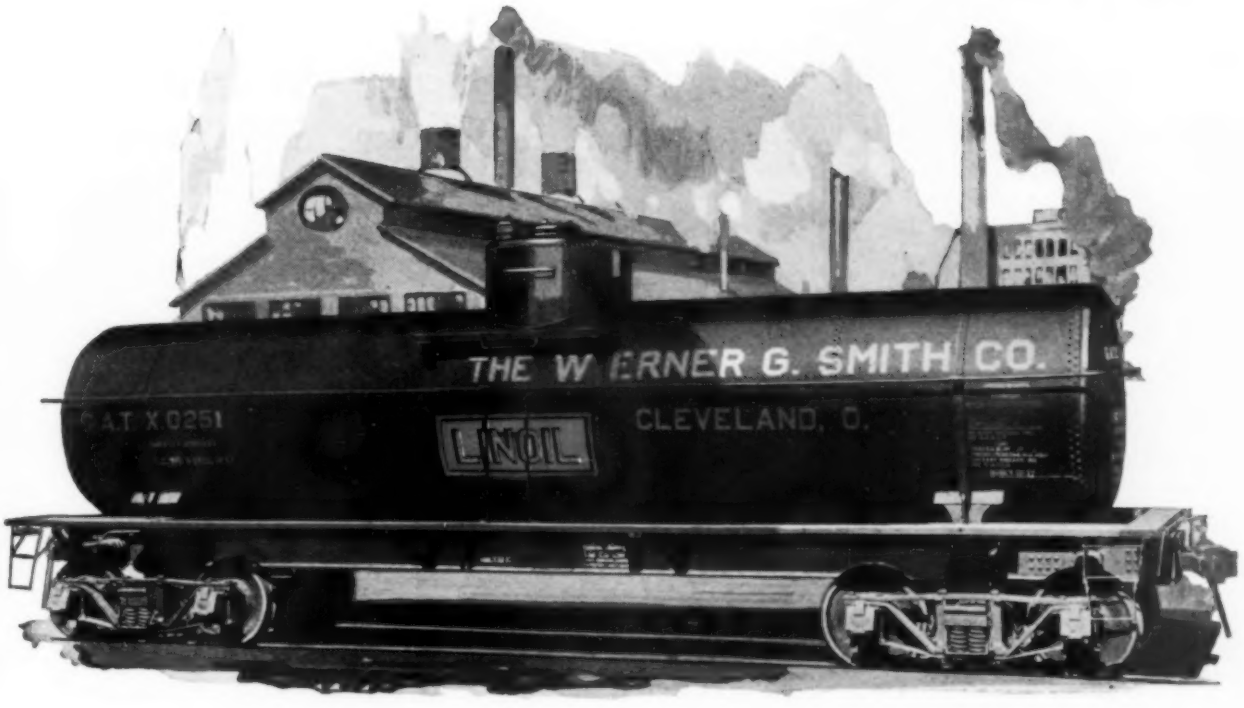
An Oil that Retains its Friendships—

When once you have standardized on Linoil and have determined its maximum possibilities in your foundry you need worry no more about core problems — your oil will run uniform, drum after drum, or tank car after tank car, and your judgment in adopting Linoil will be confirmed by unvarying results.

THE WERNER G.

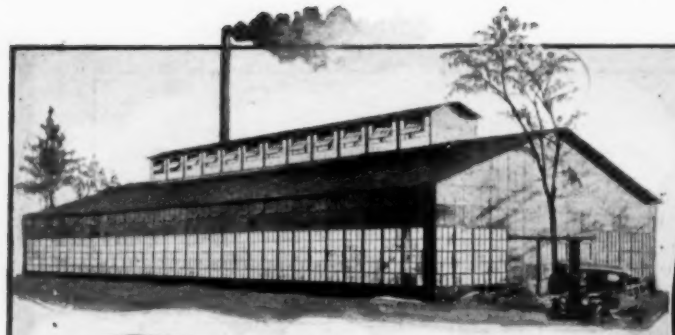
BOSTON—Mass. Trust Bldg. BUFFALO-N. Y.—85 Huntington Ave. (Crescent 5229) CLEVELAND—
CHICAGO—327 So. La Salle St. DAYTON-OHIO—28 Marie Ave. DETROIT—7333 Third Ave. (North 6210)

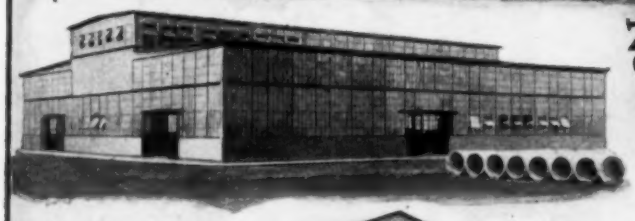
FOR ABSOLUTE DEPENDABILITY ADOPT LINOIL

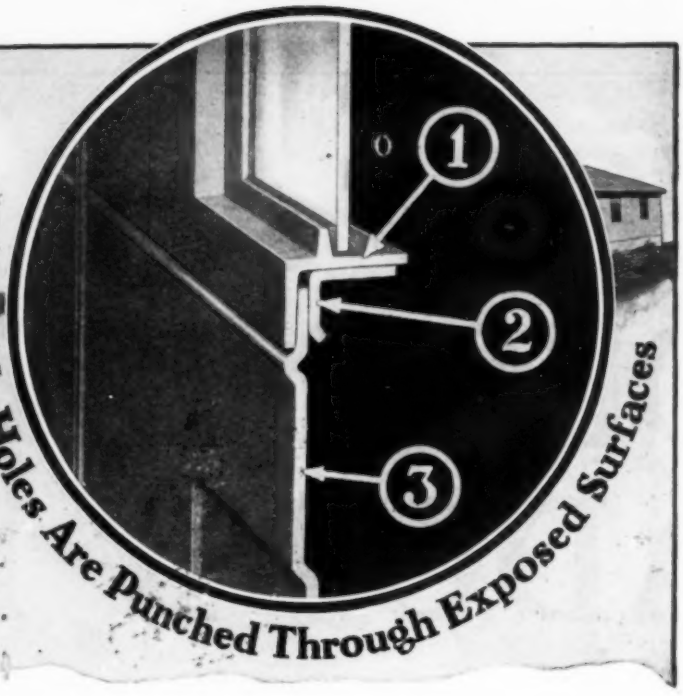


SMITH COMPANY

2191 W. 110 St. MILWAUKEE—199 Oregon St. PHILADELPHIA—1932 Com'l Bldg.
INDIANAPOLIS—18 Northeast St. MOLINE-ILL.—315 Twelfth St. SAN FRANCISCO—537 Second St.

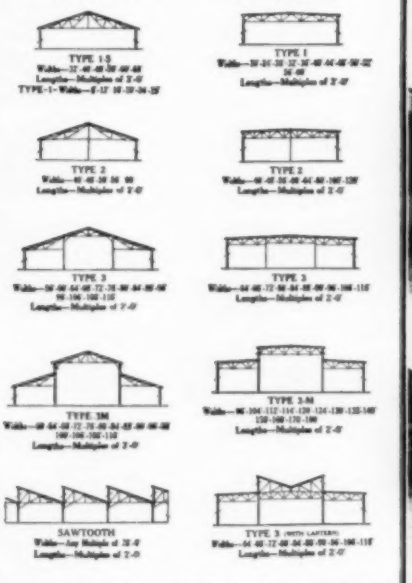




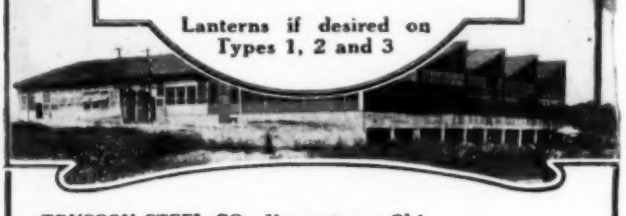


A TYPE FOR EVERY PURPOSE

Series "A" Series "B"



Lanterns if desired on Types 1, 2 and 3



Weathertight Windows

Another Exclusive Truscon Feature

The method of fitting windows into the wall panels of Truscon Standard Buildings makes possible an absolutely weathertight sidewall, without using bolts or rivets.

(1) Section of Truscon Standard Sidewall Sash.
(2) Spring Clip welded to sash insuring weathertight joint.
(3) Standard Copper-Steel Sidewall Panel.

Not a single hole is punched through exposed surfaces.

Truscon Standard Buildings offer many other features. They are permanent and weatherproof. They look good and are practical. They are individualized buildings made of standardized parts. They meet every requirement for any one-story industrial building and also many two-story types. Truscon Standard Buildings are furnished in all sizes with flat or pitched roofs, monitors or sawtooth. Other advantages are their economical cost, quick erection and 100% salvage value.

Let Truscon Engineers, who are located in 58 principal cities, work with you with estimates and suggestions on your next building.

Send coupon below for further information.

TRUSCON STEEL CO., YOUNGSTOWN, OHIO

Warehouses and Offices from Pacific to Atlantic. For addresses see phone books of principal cities. Canada: Walkerville, Ont. Foreign Div.: New York.

TRUSCON

STANDARD BUILDINGS

TRUSCON STEEL CO., Youngstown, Ohio
Send useful building book and suggestions on building to be used for

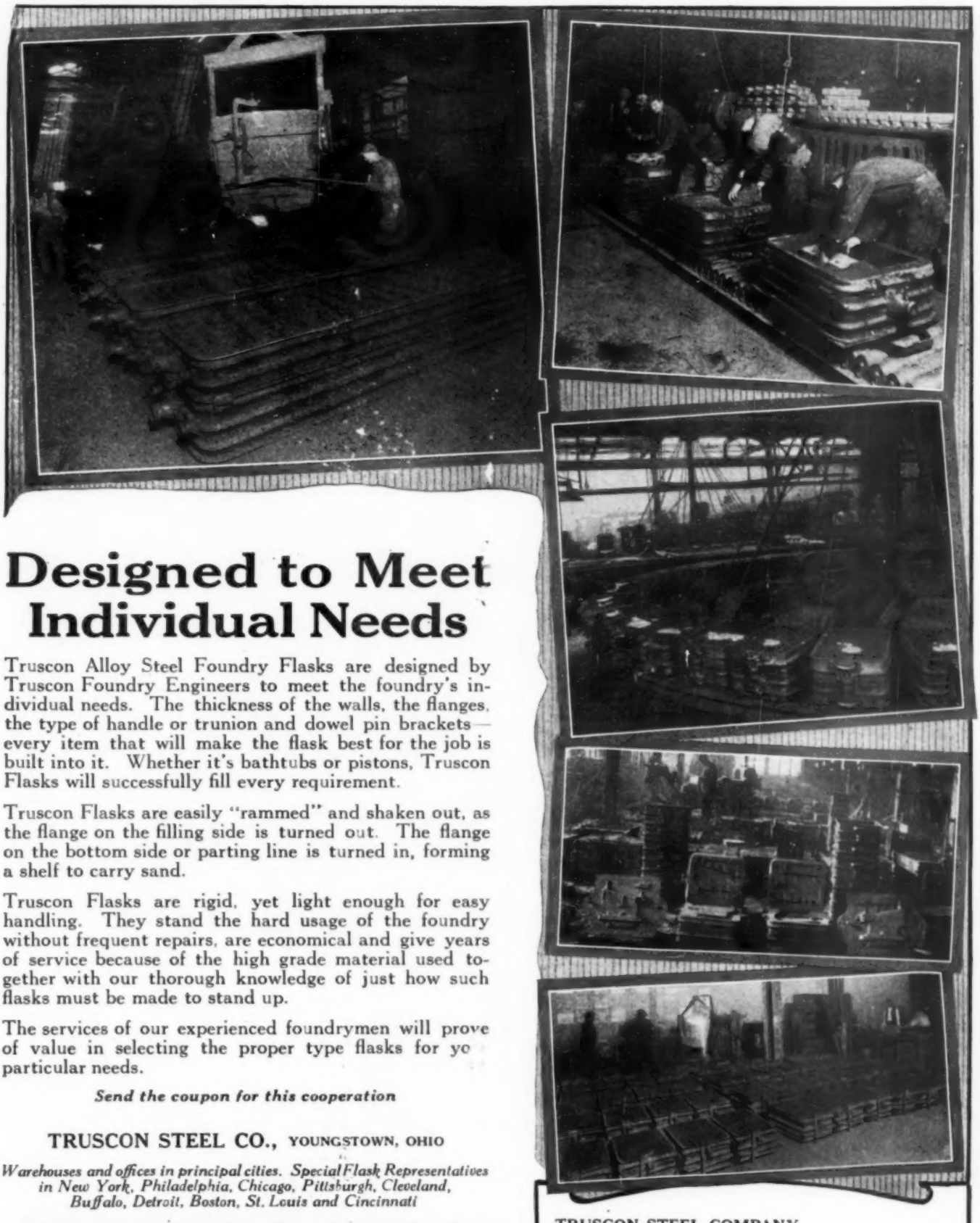
.....

Series.....Type.....Length.....Width.....Height.....

Name.....

Address.....

Fdry 12-15-24



Designed to Meet Individual Needs

Truscon Alloy Steel Foundry Flasks are designed by Truscon Foundry Engineers to meet the foundry's individual needs. The thickness of the walls, the flanges, the type of handle or trunion and dowel pin brackets—every item that will make the flask best for the job is built into it. Whether it's bathtubs or pistons, Truscon Flasks will successfully fill every requirement.

Truscon Flasks are easily "rammed" and shaken out, as the flange on the filling side is turned out. The flange on the bottom side or parting line is turned in, forming a shelf to carry sand.

Truscon Flasks are rigid, yet light enough for easy handling. They stand the hard usage of the foundry without frequent repairs, are economical and give years of service because of the high grade material used together with our thorough knowledge of just how such flasks must be made to stand up.

The services of our experienced foundrymen will prove of value in selecting the proper type flasks for yo particular needs.

Send the coupon for this cooperation

TRUSCON STEEL CO., YOUNGSTOWN, OHIO

Warehouses and offices in principal cities. Special Flask Representatives in New York, Philadelphia, Chicago, Pittsburgh, Cleveland, Buffalo, Detroit, Boston, St. Louis and Cincinnati

TRUSCON
ALLOY STEEL
FOUNDRY FLASKS

TRUSCON STEEL COMPANY
Youngstown, Ohio, U. S. A.

Please send detailed information on Truscon Foundry Flas' s.

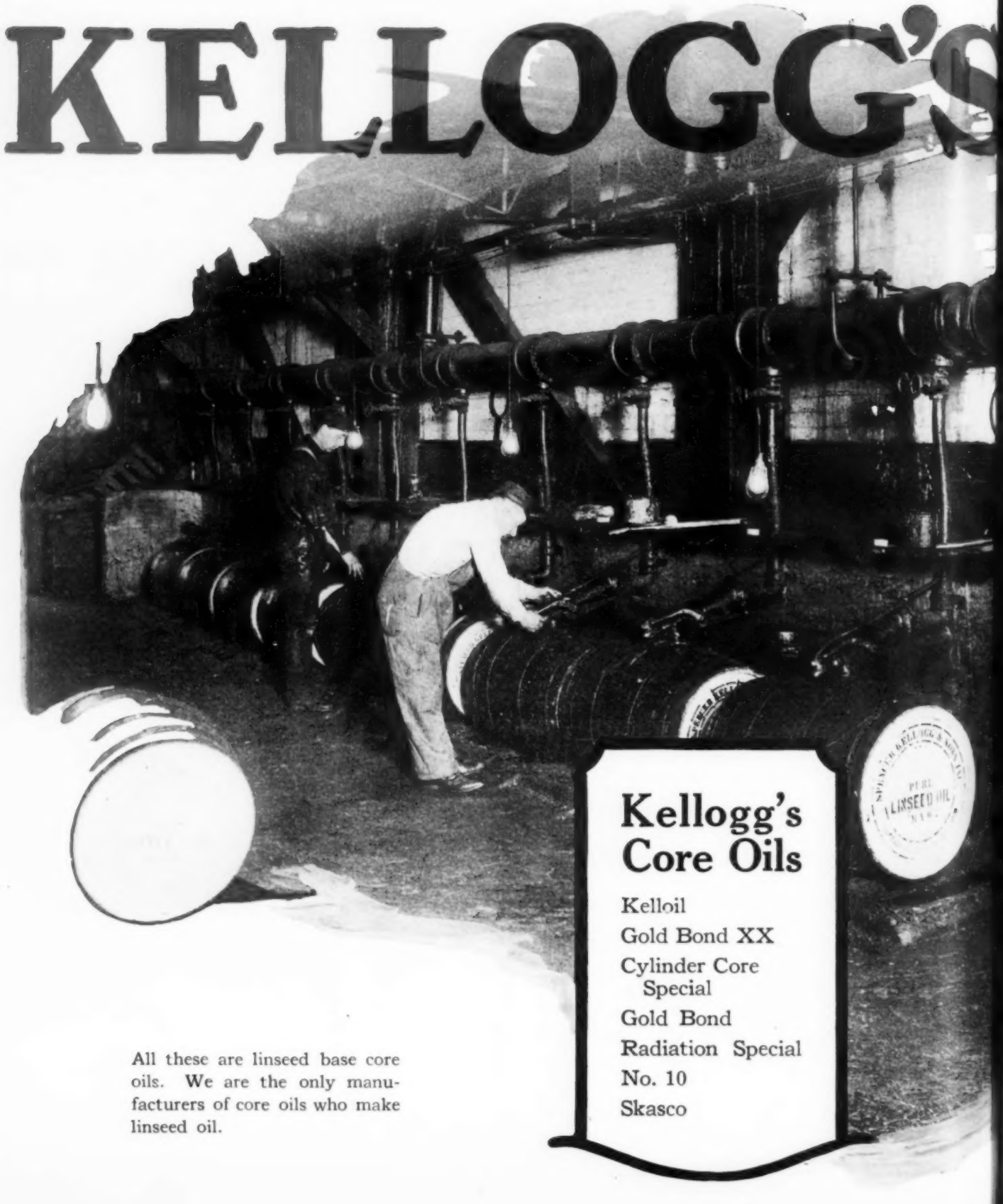
Name .....

Address .....

Fdry 12-15-24

Kellogg Service covers the foundry map of the country. Nearest warehouse or tank station is always ready with the right core oil.

KELLOGG'S



Kellogg's Core Oils

Kelloil
Gold Bond XX
Cylinder Core Special
Gold Bond
Radiation Special
No. 10
Skasco

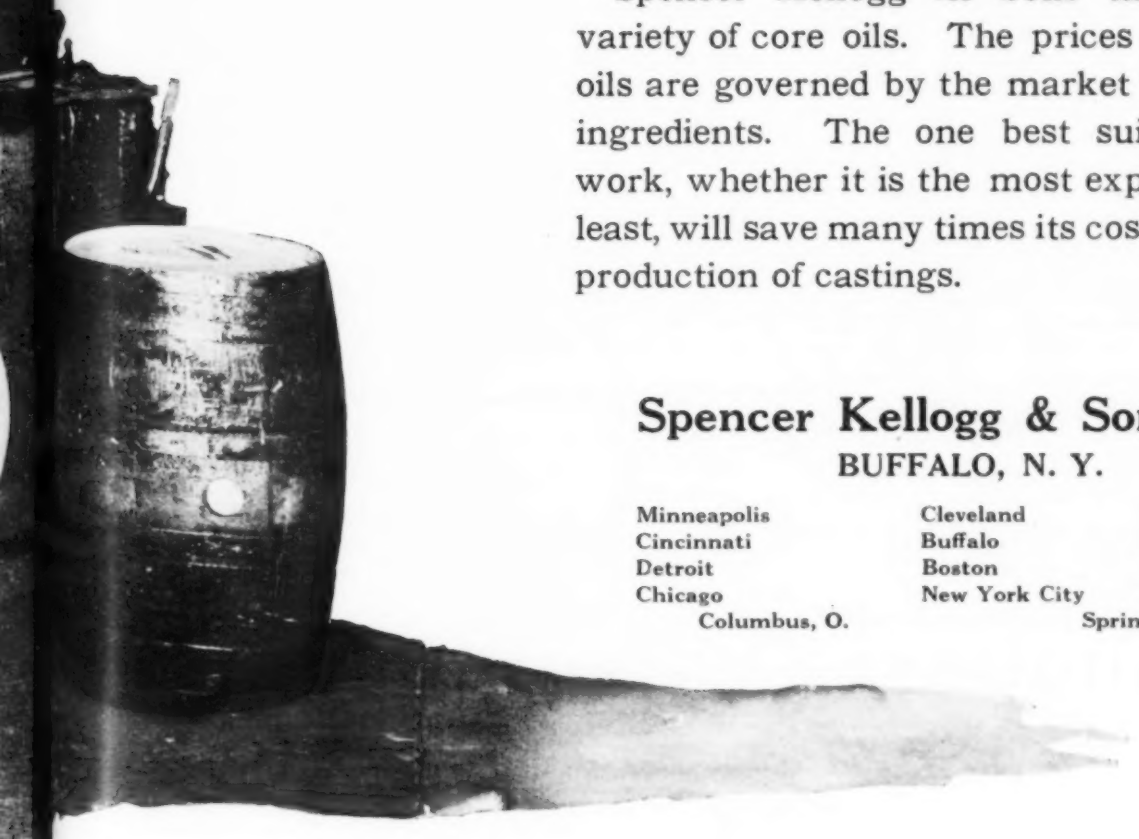
All these are linseed base core oils. We are the only manufacturers of core oils who make linseed oil.

CORE OILS

Quality That Reduces Costs

The cost of the core oil for a casting is measured in cents when the value of the casting is measured in dollars. It is economy to be sure that the core oil is dependable and uniform.

Spencer Kellogg & Sons manufacture a variety of core oils. The prices of these core oils are governed by the market value of their ingredients. The one best suited for your work, whether it is the most expensive or the least, will save many times its cost in a month's production of castings.



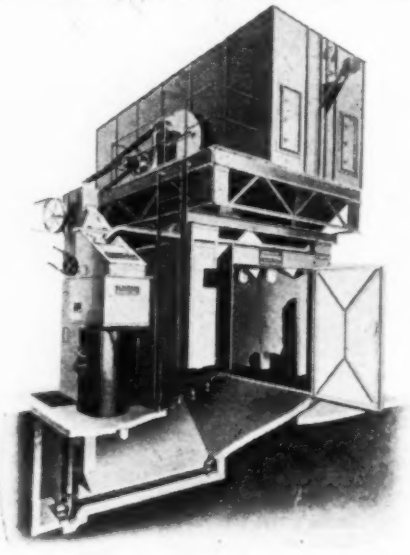
Spencer Kellogg & Sons, Inc.
BUFFALO, N. Y.

Minneapolis
Cincinnati
Detroit
Chicago
Columbus, O.
Cleveland
Buffalo
Boston
New York City
Kansas City
Philadelphia
St. Louis
Grand Rapids
Springfield, O.

Choosing a Room Sand-Blast

Analysis of Room Requirements Shows How Completely Pangborn Solves the Problem

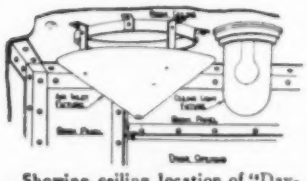
WHAT are the real factors in Room Sand-Blasting that will give steady and economical cleaning, and keep your men on the job? It is profitable analysis to compare the three essential factors—CLEAR VISION, UNOBSTRUCTABLE VENTILATION, AND DURABILITY—with the actual solution of them found in the Rooms built by the Pangborn Corporation, the world's largest manufacturers of sand-blast and allied equipment.



TYPE MO, ideal arrangement of Room, with Mechanical Abrasive Handling System. Dust Arrester and Exhauster overmounted, thus requiring minimum floor space.

Clear Vision

The conical air inlet fixtures in the ceiling of the Pangborn Room are designed to permit steady down-draft. The air moves constantly, down and away from the operator's plane of vision, and eight to twelve changes of air per minute clear the room rapidly. The design of the Pangborn Ceiling Air-Inlet Fixtures also permits location of the "Day-Bright" lighting in the ceiling. This utilizes light rays from the entire surface of the globe, evenly diffused with no shadows. Both air inlet and light fixtures are located above the top of the door opening and so are protected from breakage by any pieces that can pass the door opening. The operator sees clearly what he is blasting and completes his work rapidly and thoroughly.



Showing ceiling location of "Day-Bright" Electric Lights and Air-Inlet Fixtures.

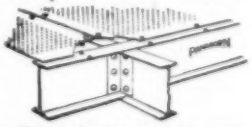
Unobstructable Ventilation

Pangborn ventilation is unobstructable. By a radical improvement in the ordinary down-draft principle, the draft-suction is turned before it reaches the floor, passing out through side ducts at floor level. No ventilation passes through the floor grates. Refuse which would clog ventlation through floor grates, increase the air cost and bring on tie-up and delay, has no effect on Pangborn ventilation.

The recommended method of abrasive reclamation is by the mechanical system. Besides other advantages, this permits the use, without change or adjustment, of Steel Abrasive as easily as sand. Pangborn was the poineer in advocating Steel Abrasive and points to the Pangborn system of mechanical abrasive handling as the most practical system developed for room use.

Thinking Five Years Ahead

Durability is appreciated more fully after use. A Pangborn-equipped foundry recently wrote: "Where other manufacturers build something of sheet metal, you build it of plate," as expression of their idea of Pangborn stability.



Floor plates are amply supported for all possible weights.

The room side structure is $\frac{3}{16}$" steel plate; the ceiling is 16-gauge; the floor gratings are $\frac{5}{16}$" steel plate and are supported by nothing lighter than 5", 9.75 lb. beams—where grating area or load necessitates, the beams are correspondingly heavier. The entire construction is unusually heavy, substantial and rigid—uninfluenced by a desire to underbid.

More Information for the Asking

Such Rooms are today giving satisfaction all over the country. They are unequalled for economy, steady operation, and durability. You should know more about the Pangborn Room. Our Bulletin No. 100 is the most complete discussion of the Room Sand-Blast that has ever appeared. To what address shall we send it?

Pangborn Corporation

Sand-Blast Equipment - Hagerstown, Maryland

DISTRICT OFFICES
CHICAGO - Railway Exchange Building
CLEVELAND - Penton Building
DETROIT - General Motors Building

PANGBORN CORPORATION RAILWAYS SERVICE RAILWAYS HAGERSTOWN, MD.

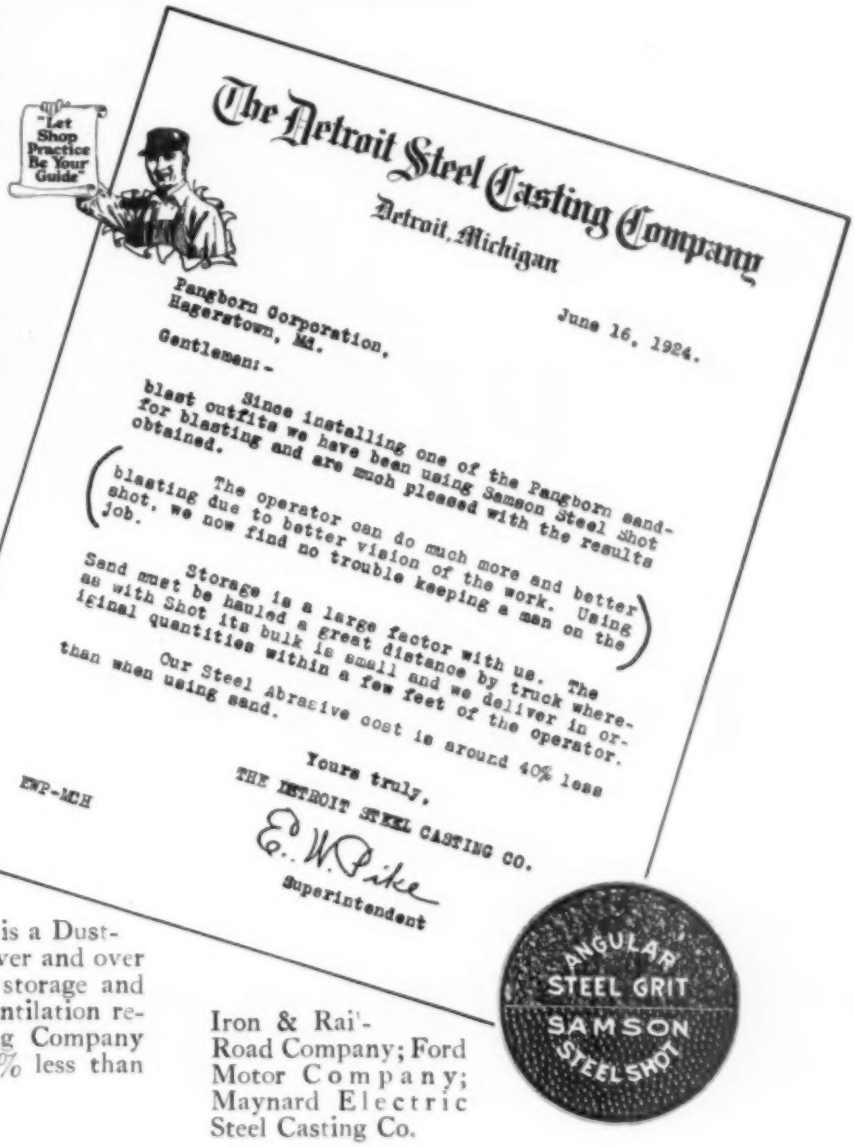
DISTRICT OFFICES
PHILADELPHIA - 4047 N. Broad Street
ROCHESTER, N. Y. - 161 Scotville Road
SPRINGFIELD, MASS. 53 Glenwood Cir.

No Trouble Keeping Man on Job

Steel Abrasives Solve a Labor Problem for The Detroit Steel Casting Company

HAVE you been worrying about dust in your blasting? Are your men complaining and laying down on the job? Would a saving in abrasive cost of 30%, 40%, or 50% please you? Are you game to try a promising experiment?

Like many other conscientious employers of labor, the Detroit Steel Casting Company was worried by the dust conditions under which their men suffered when blasting with sand. Then they put in Pangborn Equipment and upon our recommendation turned to Steel Abrasive, using Samson Steel Shot.


"Let Shop Practice Be Your Guide"
The Detroit Steel Casting Company
Detroit, Michigan
Pangborn Corporation,
Hagerstown, Md.
June 16, 1924.
Gentlemen:-
Since installing one of the Pangborn sand-blast outfits we have been using Samson Steel Shot for blasting and are much pleased with the results obtained.
The operator can do much more and better blasting due to better vision of the work. Using shot, we now find no trouble keeping a man on the job.
Storage is a large factor with us. The Sand must be hauled a great distance by truck whereas with Shot its bulk is small and we deliver in original quantities within a few feet of the operator.
Our Steel Abrasive cost is around 40% less than when using sand.
Yours truly,
THE DETROIT STEEL CASTING CO.
E. W. Pike
Superintendent
EWP-MCH

More and Better Blasting

"Using shot," says the Detroit Steel Casting Company, "we now find no trouble keeping a man on the job." A labor problem solved! Shop conditions made hygienic and "the operator can do more and better blasting due to better vision of the work."

Cut Costs 40%

A ton of Steel Abrasive will last as long as a carload of sand. Compare a piece of Steel Grit or Steel Shot with a grain of sand. While "a carload of sand makes a carload of dust," Steel Abrasive is a Dustless Abrasive and can be used over and over and over again. Besides, you cut freight, hauling, storage and refuse disposal cost and lower your air ventilation requirements. The Detroit Steel Casting Company says: "Our cost of Abrasive is around 40% less than when using sand."

A Paragraph of Users

Here is a solid paragraph of concerns that use Steel Abrasive (Angular Steel Grit or Samson Steel Shot):

Canadian Westinghouse Company, Limited; The National Cash Register Company; Sullivan Machinery Company; Buckwalter Stove Company; Allis-Chalmers Manufacturing Company; Standard Sanitary Mfg. Co.; Pawling & Harnischfeger Co.; Tennessee Coal, Iron & Rail-Road Company; Ford Motor Company; Maynard Electric Steel Casting Co.

Try Without Risk

Write us the kind of work you handle. We will suggest the proper kind and size of Steel Abrasive for your work and send enough for trial. If you don't like it, send it back. You have little to lose and much to gain.

Pangborn Corporation

Sand-Blast Equipment - Hagerstown, Maryland

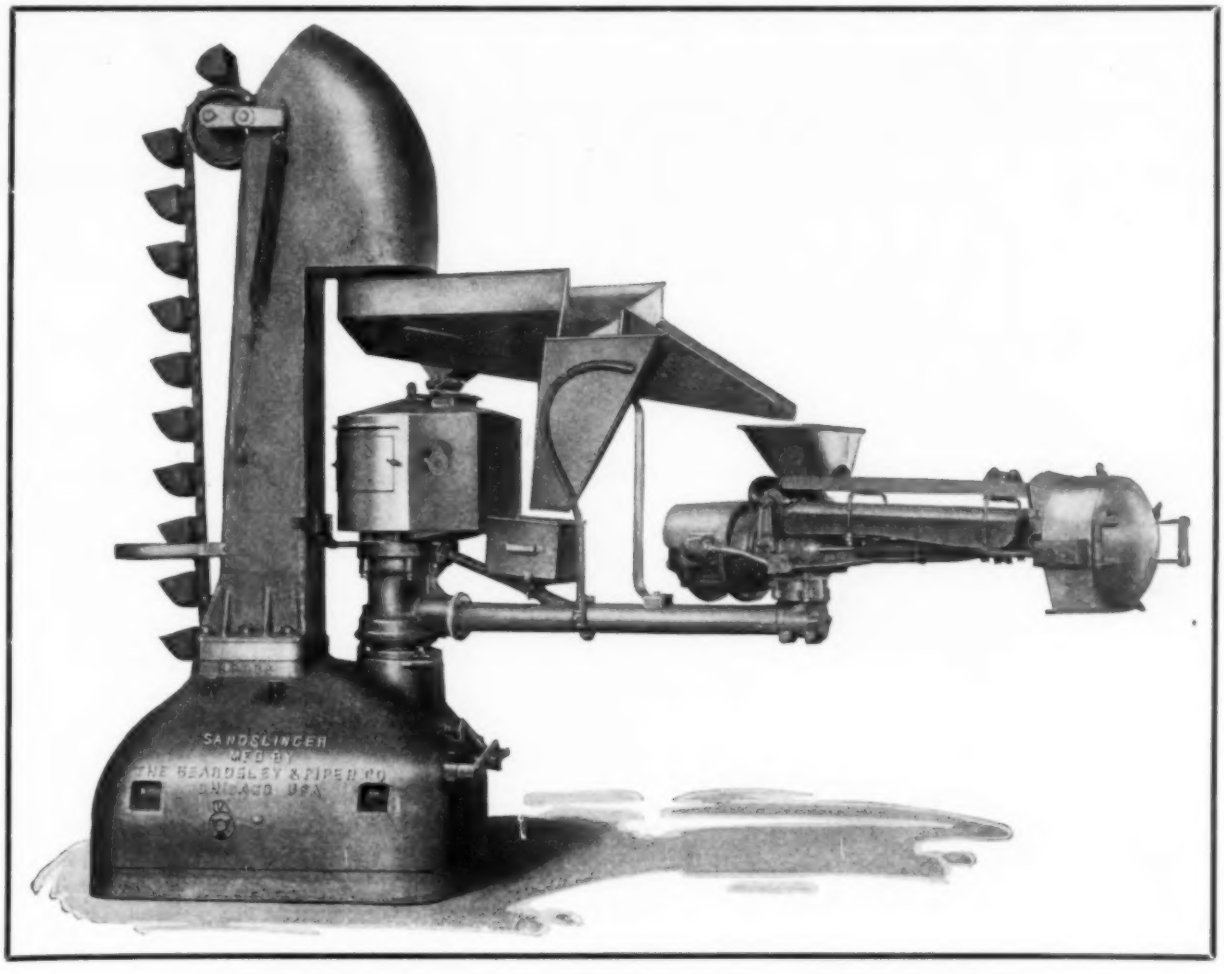
Distributor for
PITTSBURGH CRUSHED STEEL CO.
PITTSBURGH, PA.
Manufacturers of
ANGULAR STEEL GRIT

PANGBORN CORPORATION ALWAYS SERVICE AND ALWAYS HAGERSTOWN, MD

Distributor for
STEEL SHOT AND GRIT CO., INC.
AMESBURY, MASS.
Manufacturers of
SAMSON STEEL SHOT

SANDSLINGERS

represent a remarkable development in the art of molding



IT RIDDLES AND RAMS — FASTER!

A Beardsley and Piper Portable *Sandslinger* not only riddles any kind of sand, but it will ram any size mold to a depth of ten feet at the rate of ten cubic feet per minute.

The ramming is uniformly done, giving just the right face to the mold and producing more uniformly good castings.

The Portable *Sandslinger* is designed for jobbing foundries and is quickly moved to a new location. *Sandslingers* are made in five types to meet any foundry condition.

Send for Illustrated Catalog.

THE BEARDSLEY & PIPER COMPANY

2541 N. Keeler Avenue, Chicago, Ill.

Manufactured in Great Britain by Foundry Plant & Machinery, Ltd., Glasgow, Scotland
Manufactured in Germany by Graue-Aktiengesellschaft Langenhagen-Hannover
Manufactured in Canada by John T. Hepburn, Ltd., Toronto, Ont.
Sold in Australia by Metters, Ltd., Sydney, N. S. W.

BEARDSLEY AND PIPER SANDSLINGERS

KORDEK

Reg. U. S. Pat. Off.

A Foundry Necessity that assures Quality and Economy

What It Is:

KORDEK is the highest grade dry vegetable core bond. Great binding strength, combined with utmost reliability makes it extremely economical. You will find it, always, absolutely uniform and 100% efficient.

What It Does:

KORDEK produces castings of the highest grade with the smallest percentage of blowholes and imperfections—

makes cores that have sharp edges and keep them—

bakes in the shortest time—

bakes at the lowest temperature—

increases in strength while baking—

stands up when metal is poured—

leaves a clean core box—

breaks out of castings with greatest ease—

gives off the least smoke and gas—

may be mixed in large quantities, and used as needed—

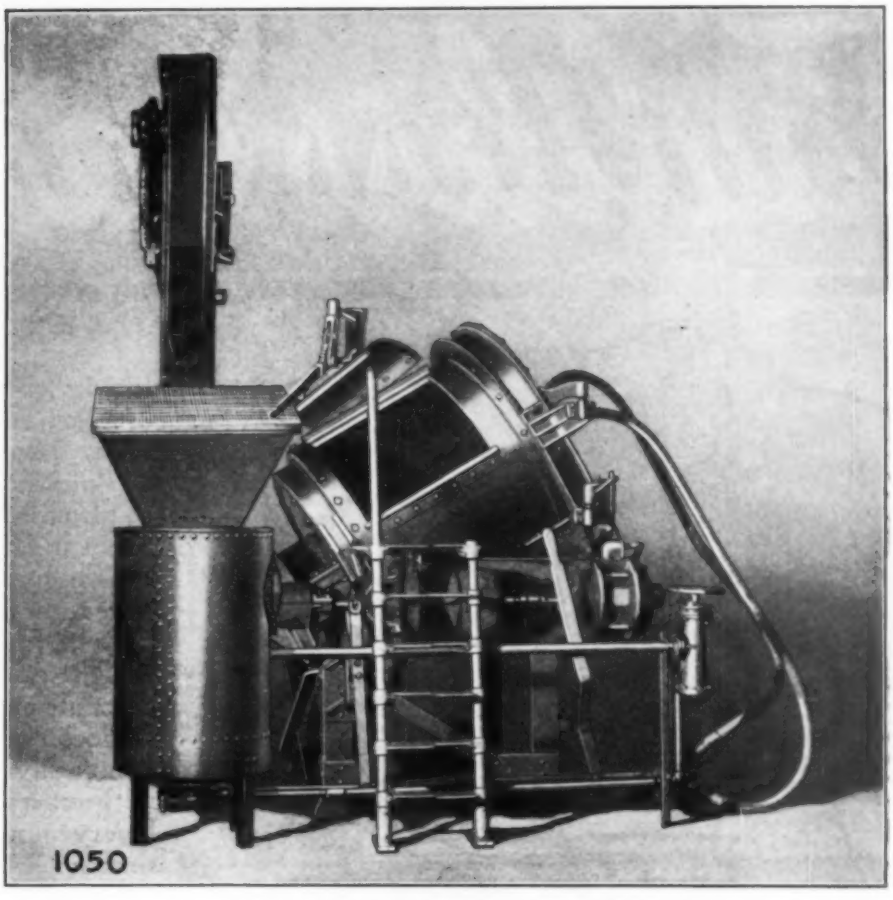
CORN PRODUCTS REFINING CO.

17 Battery Place **New York, N.Y.**

KORDEK

Reg. U. S. Pat. Off.

A Sandblast Savings Bank



No. 00 Positive Pressure Slyblast Mill "Model B"

We're talking business. Your money invested in our No. 00 Positive Pressure Slyblast Mill will pay you far better rates of interest on the better selling price you can command for your finished castings than you could receive from retaining the cost price in a bank.

Write us for facts.

THE W. W. SLY MANUFACTURING CO.

Cleveland, Ohio ***12 Branch Offices in Principal Centers***

Largest and Oldest Manufacturers of Foundry Cleaning Room Equipment
Slyblast Rooms, Cabinets, Barrels and Tables
Tumbling Mills, Cinder Mills, Dust Arresters, Foundry Equipment

SLYBLAST

for Sandblast · Shotblast · Gritblast

Faultless Parting

If you wish a parting that is perfect in every respect you will be glad to know about the following features of *Faultless Parting:*

Faultless Parting has no free or added Silica in its composition.

It is light in weight and color.

It readily takes water when swabbing a mold, and does not cut or wash.

A light dusting suffices for the most difficult and deepest lift.

It does not clog the pattern.

It readily shakes through the bag without leaving any residue.

Every pound is guaranteed to be uniform.

May we send you a trial shipment?

"Always makes a clean lift"

The Hill & Griffith Company

FACTORIES
CINCINNATI, O.
BIRMINGHAM, ALA

Cincinnati, O.

BRANCH WAREHOUSE
3900 So. UNION AVE.
CHICAGO, ILL.

H&G QUALITY

Our Specialties:

No. 118
EAST INDIA PLUMBAGO
BULL DOG CORE PASTE
KORO BLACKING
CHAPLETS
EBONY
CORE COMPOUND
GLUTRIN
GOULAC

In order that we may better serve our Southern customers, we manufacture a complete line at Birmingham, and for our Northwestern trade we carry a complete stock in our Chicago warehouse. This insures quick delivery and lower freight rates.

This advertisement (in Nov. 1 Foundry) is repeated—by request.

THE NEED OF THE FOUNDRY INDUSTRY IS NOT MORE FOUNDRIES, BUT BETTER FOUNDRIES

The investment in proper plant remodeling and modernizing pays dividends of from 30 to 100%.

In one instance we have, during the past 3 years, completely revamped a steel, grey iron and brass foundry and machine shop plant; increasing production 100% by many minor changes in plant layout, buildings and equipment.

The cost in three years totals $200,000.00. The annual savings are now $200,000.00.

This job included improvements in every operation from raw material storage to the shipping room.

Most old foundries and shops and many new ones need improvements.

CHASE SERVICE, EXPERIENCE, ORGANIZATION, REFERENCES

All go to make an interesting and unusual story of accomplishment in industrial buildings which may have an application to your proposed plant. May we tell you this story, and discuss your building, or rehabilitation project with you, without obligation on your part?

Booklets on request

FRANK D. CHASE, INC.

Engineers and Architects

720 N. Michigan Ave.

CHICAGO

Hercules Rosin Makes Uniformly Strong Cores

You can count on uniform high quality in Hercules Wood Rosin for both dry and liquid core binders. Without exception every founder or core oil manufacturer who has tested it with the co-operation of our technical service representatives has found it unusually satisfactory.

Hercules Wood Rosin is produced under strict chemical control, which enables us to maintain a uniformly high melting point and a low volatile content in every lot. This prevents excessive smoking while baking or pouring as well as excessive foaming when the rosin is used in making core oil.

Extensive tests and actual foundry use have proved that Hercules Rosin imparts a high tensile strength to cores.

Write for specifications and prices.

HERCULES POWDER CO.

Wilmington **Delaware**

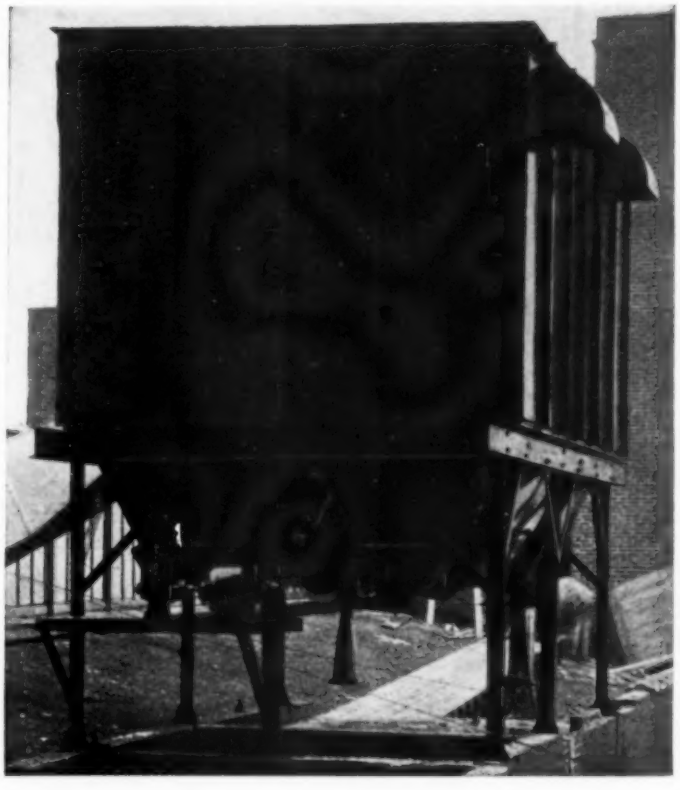
SALES OFFICES:

New York, N. Y.
Chicago, Ill.
San Francisco, Calif.
Chattanooga, Tenn.
St. Louis, Mo.
Louisville, Ky.
Buffalo, N. Y.
Duluth, Minn.
Birmingham, Ala.

HERCULES
Naval Stores
Produced Under Chemical Control

Do You Know You Can *End* Dust and Fumes in Your Plant

Can't do Good Work in a Dusty Room!



End Dust in your Plant—It Pays!

Paxson Dust Collector collects 98 per cent of the fine powder and dust which floats in the air. The dust is conveyed by suction through galvanized pipes to the base of the collector. The heavy dust drops into the hopper. The floating dust is caught by cloth screens, and the clean air is discharged by a steel plate exhaust fan.

The dust collector is made of No. 16 black sheet steel, reinforced on all corners, sides and top with steel angles. The casing will not buckle or collapse. All joints are made tight. Doors give easy access to interior of collector.

A motor-driven mechanical device is provided to shake the accumulated dust from the screens. Small dust collectors are provided with hand-power shaking device. In many industries Paxson Collectors have paid for themselves by recovering valuable materials.

See other advertisement on back cover

J. W. Paxson Co.
PHILADELPHIA

Baltimore Office—217 Luzerne Ave.; Detroit Office—2937 East Grand Blvd. Newark Warehouse—48 Van Buren St., Newark, N. J.; Providence Warehouse—Providence News Bldg.; Rochester Office—125 Troup St.

A Safeguard Against Casting Losses and a Guarantee of Economy

"K-B" Core Binder and Facing Flour is NOT a compound, and it is guaranteed to be always uniform in quality.

It is invaluable in the production of steel, malleable iron, gray iron, brass and aluminum castings.

Some reasons why "K-B" Core Binder and Facing Flour is strongly recommended by users, everywhere.

(1)—"*K-B*" burns quickly in the casting, making the core collapsible and easy to discharge.

(2)—"*K-B*" makes a perfect green bond combined with openness.

(3)—"*K-B*" is unusually successful in securing a good peel from the casting, smoothness of cores, clean drawing from boxes and resistance to cutting.

(4)—"*K-B*" is quick drying, which is a very important function in the use of Dry Binders.

(5)—"*K-B*" blends uniformly with oil, and brings about substantial savings. It proves of great value from the standpoint of producing collapsible cores of smooth peeling qualities.

Let us tell you all about "*K-B*" *Core Binder and Facing Flour*—and send samples. Write!

K TRADE MARK B

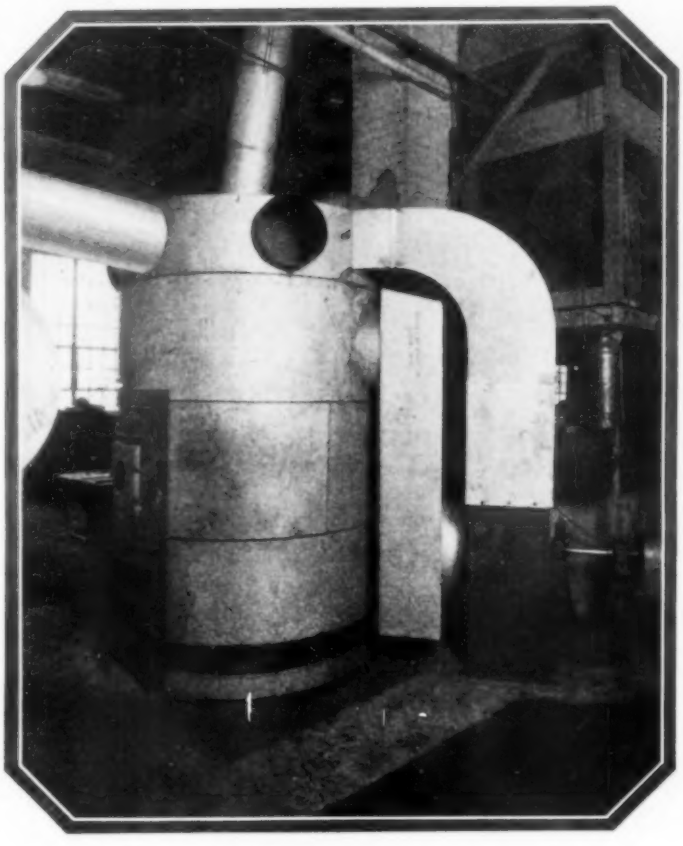
Knefler-Bates Manufacturing Co., Indianapolis, Ind.

Distributing Warehouses located in all principal American Cities.

Agents for Great Britain, Yorkshire Amalgamated Products, Ltd., 27 Waterdale, Doncaster, England

Agents for Scandinavian Countries, Otto Madsen, Copenhagen, Denmark

This Concern Saves $400 On Labor Alone!



Mechanical Hot Blast Heater at Akron Equipment Co.

Sturtevant Mechanical Hot Blast Heater eliminates the cost of skilled engineers or boiler men.

Here's what C. R. Quine, Manager, The Akron Equipment Company, Akron, O., says:

"Our chief purpose in installing a Sturtevant Hot Blast Heater in our machine shop building five years ago was to eliminate the necessity of having a man on the job nights, Sundays and holidays to prevent steam and hot water pipes from freezing, as it is necessary with anything but a direct hot air heater. We also found the Sturtevant Heater much cheaper to install.

"The machine shop building is 215 ft. long by 60 ft. wide, with high monitors used for crane runways. It is of brick and steel sash construction, exposed on all sides, and has large doors that must be opened frequently.

"But the Sturtevant system maintains a remarkably even temperature throughout the building, regardless of wind and weather conditions and the distance from the heater outlets. Even in cold weather it holds the temperature of the shop at 60°, with only 3° variation at the breathing level.

"The Sturtevant plan of drawing the cold air off the floor, heating it, and then distributing it through the room under pressure, works very satisfactorily. The Sturtevant Heater is well made. It has extremely large heating surface as compared to the diameter of the fire pot and is economical in consumption.

"Equally satisfactory heating could be obtained only by installing a much more expensive steam boiler and piping equipment. This would require a man on the job all the time during cold weather to prevent frozen steam pipes, costing $400 a year extra for labor. The man who does our cleaning takes care of the Sturtevant, giving only a small part of his time to it.

B. F. STURTEVANT COMPANY

Sales Engineering Offices

Atlanta, Ga.; Boston, Mass.; Buffalo, N. Y.; Camden, N. J.; Chicago, Ill.; Cincinnati, Ohio; Cleveland, Ohio; Dallas, Tex.; Denver, Colo.; Detroit, Mich.; Hartford, Conn.; Indianapolis, Ind.; Los Angeles, Cal.; Montreal, P. Q.; New York City; Pittsburgh, Pa.; Portland, Ore.; Rochester, N. Y.; St. Louis, Mo.; Salt Lake City, Utah; San Francisco, Cal.; Seattle, Wash.; Toronto, Ont.; Washington, D. C.

Plants located at

Hyde Park, Mass. Berkeley, Cal. Camden, N. J.
Sturtevant, Wis. Framingham, Mass. Galt, Ontario

Sturtevant
PUTS AIR TO WORK

Foreign Representatives

Sturtevant Engineering Co. Ltd., London; Sturtevant Cie Paris; American Trading Co. Tokio; American Trading Co. Shanghai; Catton Neill Eng. and Mach. Co., Manila; H. P. Gregory & Co., Ltd., Sydney; Blair, Reed & Co., Ltd., Wellington; Wesselhoeft and Poor, Caracas; Wesselhoeft and Poor, Bogota; General Machinery Co., Tampico; Pedro Maritino, Inc., Lima; Compania Italio-Americana de Importacion, Buenos Aires; A. E. Barker, Johannesburg.

1146A

FOUNDRY SUPPLIES

Shovels Bellows
Sieves Buckets
Brushes Swabs
Rammers Chaplets
Coke Forks Flour
Coke Baskets Stars
Hay Rope Vent Wax
Floor Hammers
"Curbay" Binder

Immediate shipment from our Philadelphia warehouse.

FOUNDRY FACINGS

Armor Core Blacking
Seacoal Facing
Hifracto Furnace Cement
Snowflake Parting
Soapstone

Our facings are made of carefully selected graphite and are guaranteed to give satisfactory service.

Grades for all classes of work.

FOUNDRY SANDS

Moulding:

Albany
North River
Lumberton
Tullytown
Catawissa

Millville Gravel

Steel Sand:

Strong silica
Sharp silica

Fire Sand
Fire Clay
Blast Sand

You can depend on our supplies being of standard quality and manufacture and you can rely upon their giving dependable and economical service—always.

After years of careful research and experimental work, we have standardized on grades and qualities of facings that have proved to be best suited for each particular class of work in the foundry.

With deposits of foundry sands geographically located to give foundrymen the highest qualities at minimum prices and freight rates, we can give the maximum of service.

GEORGE F. PETTINOS
SANDS AND SUPPLIES
PLUMBAGO FACINGS

GEORGE F. PETTINOS

1206 Locust Street, Philadelphia, Pa.

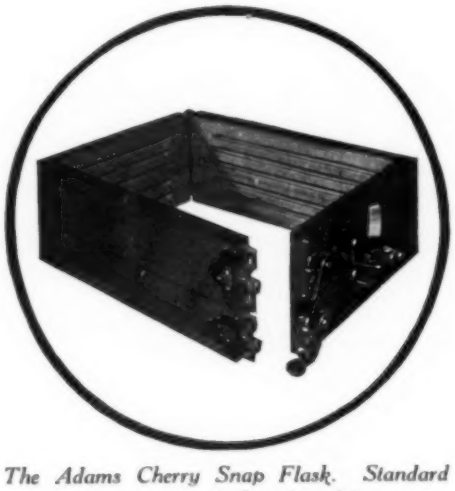
Boston Pittsburgh Montreal

ADAMS STEEL JACKETS
ARE AN ASSET TO PRODUCTION

They are durable. They hold their shape and, unlike wooden jackets, will not burn or break.

They are economical. Only a sufficient number of jackets are used that will equal the number of molds poured with one ladle.

They eliminate runouts by sealing the parting line and supporting the mold equally on all sides.



The Adams Cherry Snap Flask. Standard equipment in leading foundries.

CONSTRUCTION

Made of No. 10 gauge steel, reinforced on the corners by strong angle irons electrically spot welded into position. Angle irons welded on the sides and ends. Wooden handles provided for convenience in handling.

ACCURACY

Made special to order, in exact conformity with your specifications. When ordered with Adams Cherry Snap Flasks, each jacket is tried out on a mold made in the flask, before shipment.

Furnished with straight sides, or with any desired taper. Special shapes to order.

The Adams Company, Est. 1883 — 170 Foster Street, DUBUQUE, IOWA

SAND

What You Want to Buy

vs.

What We Want to Sell You

In selling Blackhawk Brand molding sand we are more interested in what our customers want to buy, than in what we want to sell them. In other words, we credit the customer with having learned, through long years of practical experience, from just what grade of sand he will get the best results.

As an example, one of our customers uses two entirely different grades of sand, in two of their foundries—*for exactly the same purpose.*

We might say that either or both of the Superintendents of these foundries are wrong—and try to force them to buy the sand *we* want to sell them. As a matter of fact, both are *right*, for they have learned by study and experience what sand brings the best results with the mixture they are used to employing.

This is the sort of service you get when you buy Blackhawk Brand sand.

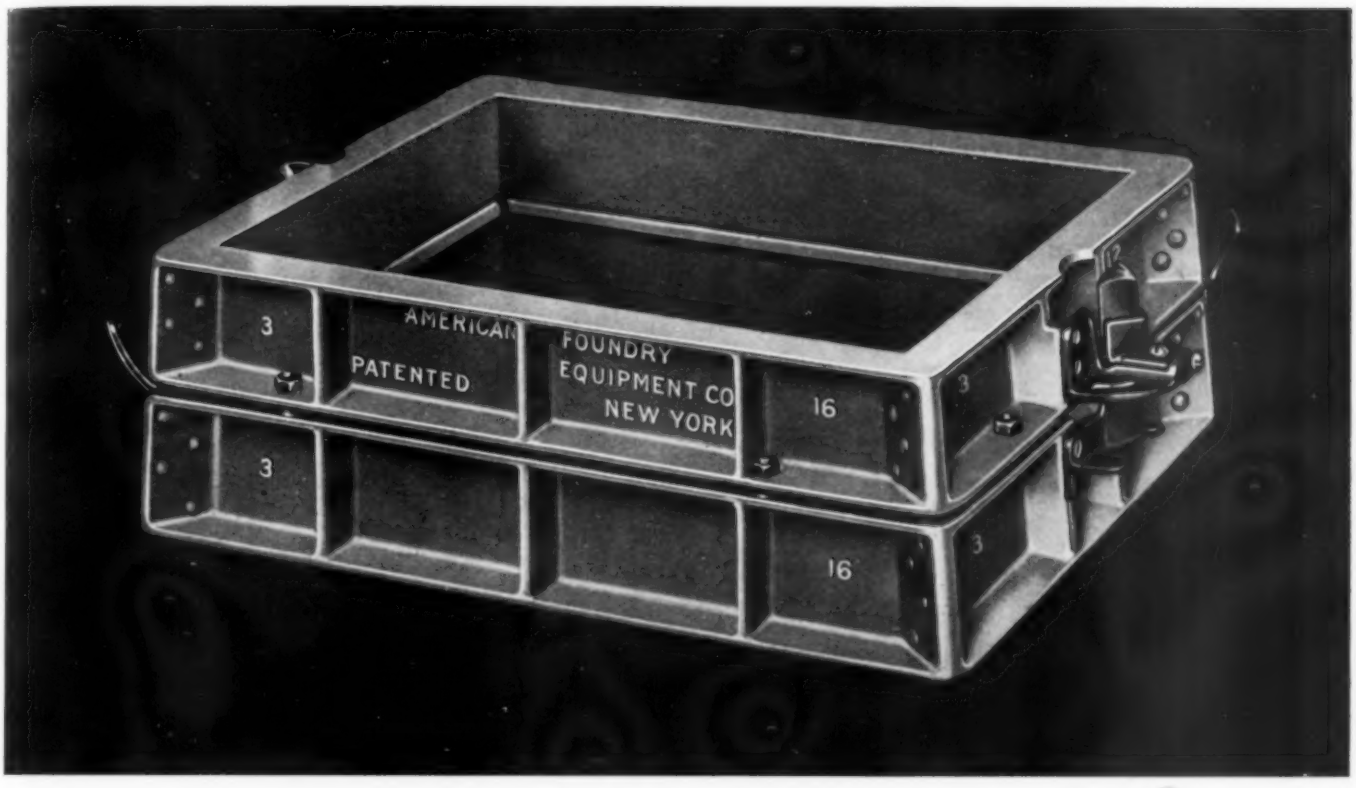
BLACKHAWK BRAND

STANDARD SILICA *Company*

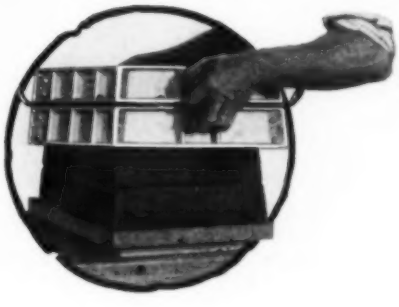
Plants at Ottawa, Illinois

General Offices: 39 South La Salle Street, Chicago

DAILY CAPACITY, 1,000 TONS
YEAR 'ROUND DELIVERIES
LARGE STORAGE FACILITIES
PROMPT ATTENTION TO ALL ORDERS



Here is a Snap Flask!



Made of durable non-warping material—cast aluminum.

Built on the taper-lift-off system. Corners all closed and rigid.

Finished inside on a special milling machine—dead accurate.

Cope and drag machined level, avoiding cracked molds and fins.

Adjustable pins—any style.

Problem:

Which puts more money into your pocket: (1) Saving a little on a snap flask; or (2) saving the molds a poor flask spoils?

To solve:

Try an American Snap Flask. Return it if you don't like it.

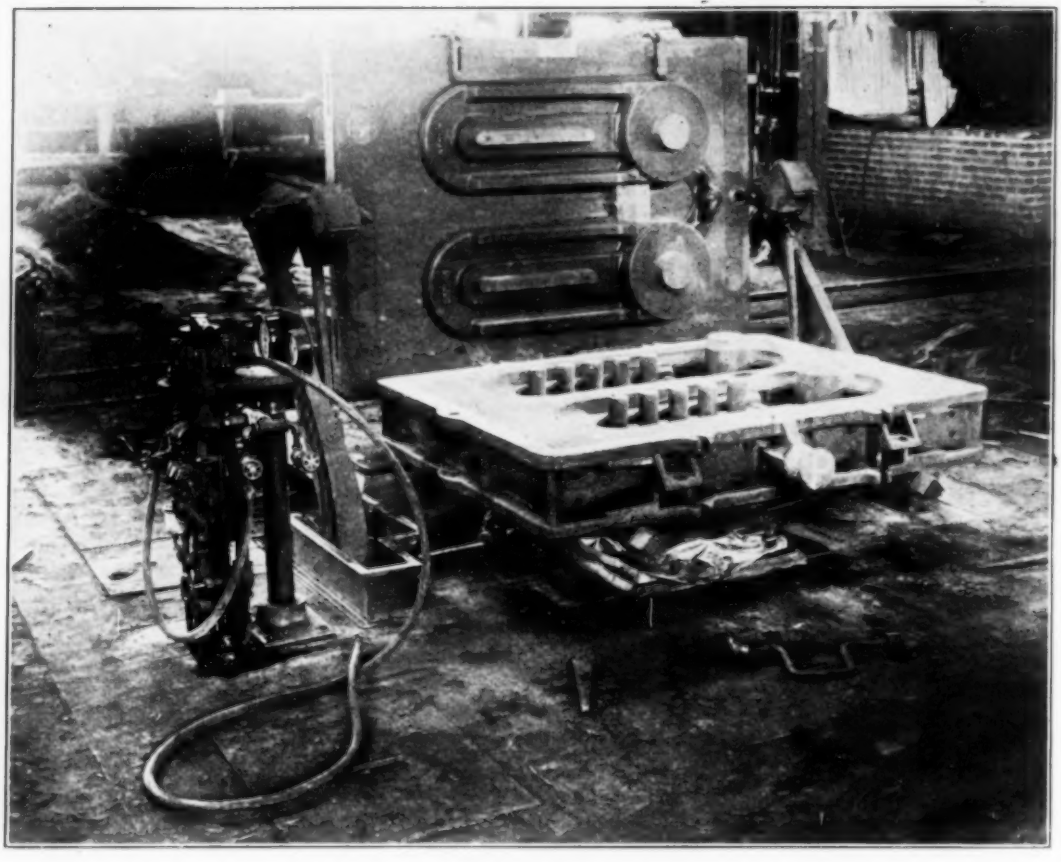
The American Foundry Equipment Co.

368 Madison Avenue, New York, N. Y.

Direct representatives in principal foundry centers.

AMERICAN FOUNDRY EQUIPMENT

If It's A Herman It's Worth Using. It Made Its Way by the Way it's Made



Doubling Production on Herman Machines

Herman Jar Independent Rollover and Pattern Drawing Machines are *your guarantee for speedy production* of work that is of a medium or larger nature.

With a "Herman," any mold can be jarred in less than a minute's time.

Write us the nature of your work and we shall send you full details regarding the size and type of Herman Molding Machine that will meet your requirements most profitably.

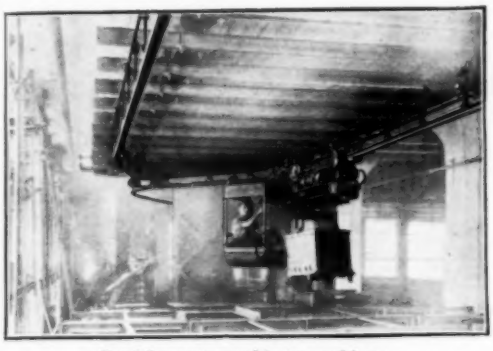
Herman Pneumatic Machine Company

GENERAL OFFICES Union Bank Building **PITTSBURGH, PA.**

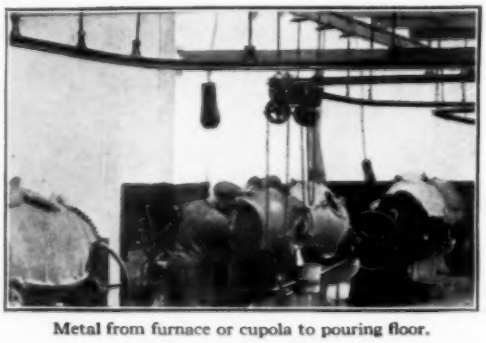
MANUFACTURING PLANT: ZELIENOPLE, PENNSYLVANIA, U. S. A.

Foreign Works: Pneumatic Engineering Appliances Co., Ltd., 14 New Burlington St., London S. W. England.

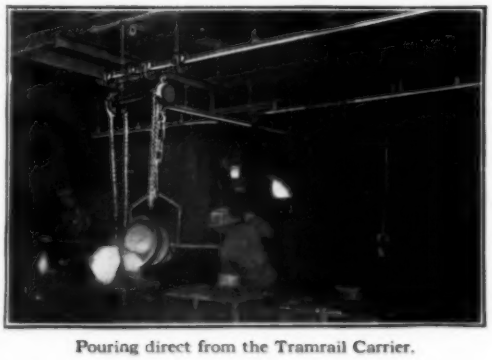
CLEVELAND HAND OR ELECTRIC TRAMRAIL



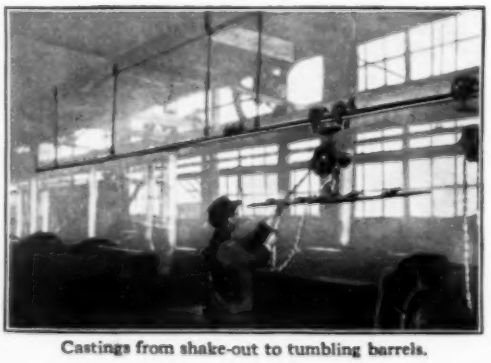
Sand from storage bin to machines.



Metal from furnace or cupola to pouring floor.



Pouring direct from the Tramrail Carrier.



Castings from shake-out to tumbling barrels.

What More Can You Ask!

Here's a list of the "lift and carry" operations which Cleveland Tramrail performs in the foundry. Check it over carefully for omissions — we'd like to know if any handling system could do more.

Core Room—*Sand* from stock to mixer and then to core makers' benches.

Racks and dryers to core machines, finished cores to ovens, from ovens to foundry floor.

Core machines lifted and placed.

Foundry Floor—*Flasks, bottom boards and heavy patterns* from storage yard to pouring floor or molding machines.

Facing sand from mixers to molding stations.

Molds from machines to floor where they are closed.

Ladles or *crucibles* to preheating station, to cupolas or furnace, *metal* from melting units to pouring floor — pouring direct from carrier.

Castings from floor to cleaning department; *waste material* to trucks or dump; *flasks* to shake out floor, then to storage; *sand* to mixer.

Cleaning Department—*Castings* to grinders, tumbling mills or sand blast cabinets, then to cutting or welding department, finally to shipping room and loading for delivery.

Annealing Department—*Steel castings* to soaking pits or annealing ovens.

Malleable castings and *packing material* to annealing department; *annealing boxes* on and off charging cars.

Can our engineers be of any assistance in planning a Tramrail Installation for any of the above operations in your own plant?

Our 225 page, illustrated catalogue features a number of foundry installations. Write for a copy or for special information on your particular handling requirements.

CLEVELAND ELECTRIC TRAMRAIL

DIVISION OF

THE CLEVELAND CRANE & ENGINEERING CO.

WICKLIFFE OHIO.

Branch Offices:

New York City, 30 Church St.
Pittsburgh, 500 Arch St.
Chicago, 557 Ry. Exchange Bldg.
St. Louis, 1309 Pine St.
Pittsburgh, 511 Farmers Bank Bldg.
Detroit, 149 E. Larned St.
Philadelphia, 2401 Chestnut St.
San Francisco, 16 California Street
Los Angeles, 422 East 3rd Street

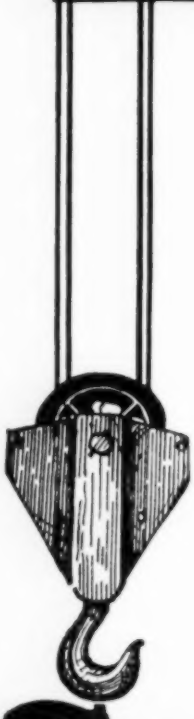
Above—Five 5-ton Cleveland Cranes inside the new foundry of the Kensington Davis Corporation. Left—Yard Crane of same capacity at this plant.

Six Cleveland Foundry Cranes

There is a close relation between cranes and output in the foundry department. The time required to do the work can be greatly reduced by proper crane equipment—and "time saved" in this case means *more castings* from the same floor and molding crew.

The Kensington Davis Corporation have recently installed six new Cleveland Foundry Cranes in the foundry of their new plant at Buffalo. Five of these will speed up production on the molding floor. The sixth operates over the storage yard handling sand, flasks, pig, coke and all the other outside work.

Cleveland medium capacity cranes are given the same engineering care and construction supervision that has made our heavier cranes famous in steel mills. Every Cleveland Crane is designed for the work it is bought to do.



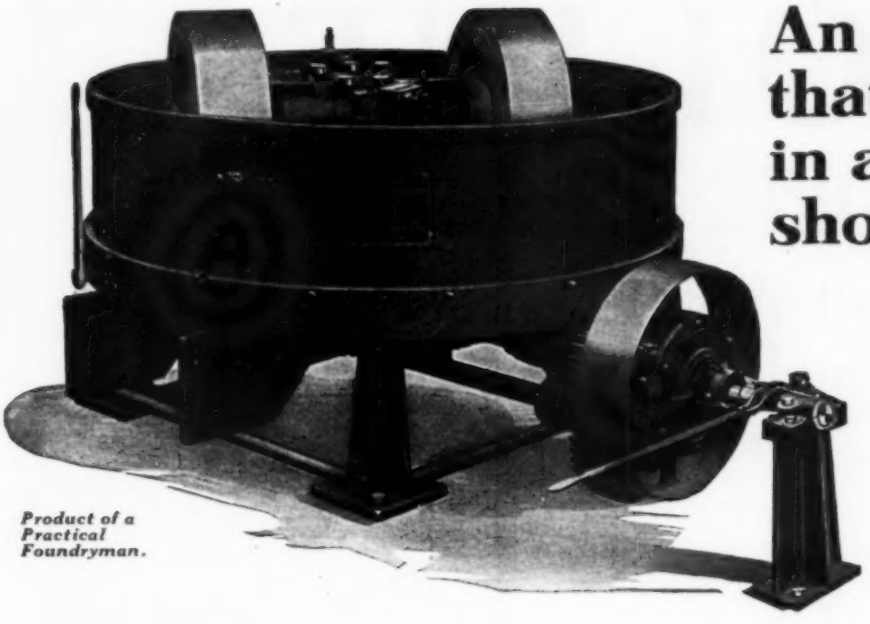
THE CLEVELAND CRANE & ENGINEERING CO.

New York City
30 Church Street

WICKLIFFE OHIO.

Pittsburgh
511 Farmers' Bank Bldg.

CLEVELAND CRANES



Product of a Practical Foundryman.

An Investment that pays for itself in an incredibly short time!

SIMPSON

Intensive Sand Mixer

What we mean by INTENSIVE mixing of foundry sands:

The **Simpson Intensive Foundry Mixer** has properly designed, adjustable mullers, of correct size and weight, which squeeze and knead the sand without breaking the grains. The plows very quickly amalgamate the various ingredients as well as heap up the sand in the pathway of the mullers. The mixing action is so thorough that each grain of sand is quickly surrounded with the thinnest possible coating of new molding sand or clay or with compound, wet binder or oil, whichever is used.

Intensive mixing, then, is a thorough turning over, squeezing and kneading. This is possible only with a muller type mixer, and is accomplished only with maximum efficiency, including a considerable saving of labor, less new sand or binder. The highest quality of mixtures is constantly maintained.

THE PRODUCT OF A PRACTICAL FOUNDRYMAN

Hundreds of foundries are enjoying big savings through the use of the "Simpson"—and there is nothing to stop you from doing the same.

Simpson Intensive Sand Mixers are made in four sizes to suit capacity of any size shop.

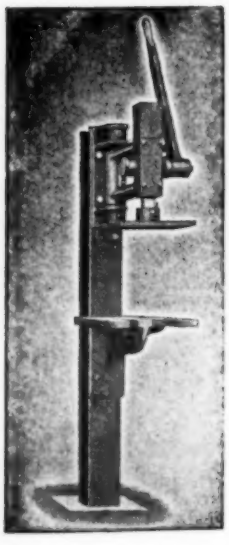
Write for list of users and descriptive bulletins.

NATIONAL ENGINEERING COMPANY

MACHINERY HALL BUILDING 549 W. WASHINGTON BLVD.

CHICAGO, ILL., U. S. A.

MOLINE
MOLDING MACHINES
Are Used in all Well Equipped Foundries Producing Small and Medium Castings



No. 1 Stationary Machine

ADVANTAGES

Eliminates the high cost of compressed air.

All working parts are above the table; consequently, sand cannot get into the mechanism.

Requires but 25 sq. in. floor space for No. 1 machine.

Approximately one - half the number of working parts as compared with many other types of moulding machines.

The swinging arm balanced on hardened steel center.

Can be swung right or left at the will of the operator, making it convenient for bench moulding as well as for squeezer work.

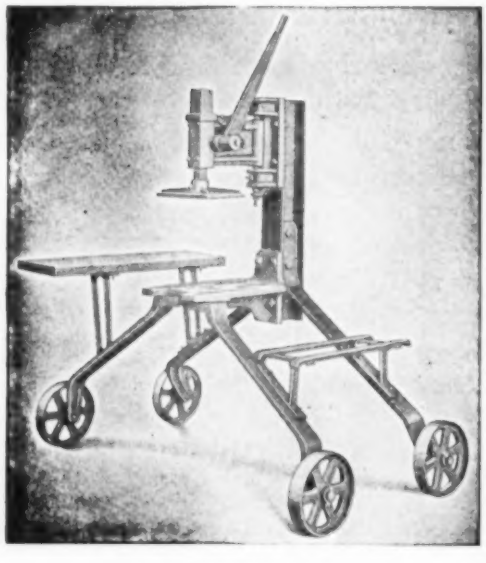
The parts are made of steel, malleable iron, and semi-steel castings, thus insuring long and economical service.

Can use flasks as large as 12" x 24"

As many as 285 moulds (10" x 16" flasks) have been made in 7½ hours.

Total price of the machine should be absorbed by reduced cost of production within six months after purchase.

No. 2 Portable Machine



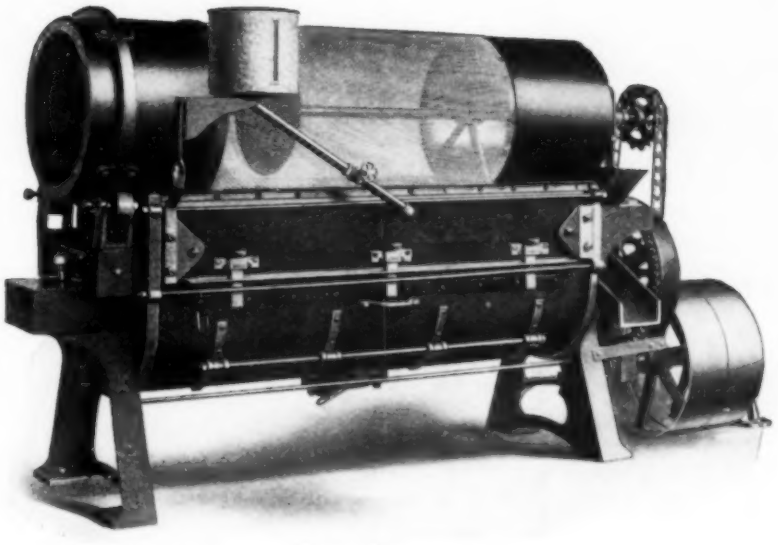
No. 3 Portable Machine

Order a sample machine and you will want more of them as they will increase your output and profits.

MOLINE IRON WORKS
MOLINE, ILLINOIS
U. S. A.

STANDARD MIXERS BUILT SINCE 1900

Your men can't blame it on the sand



Probably your molders like others, sometimes blame their troubles on poor facing sand and poor cores. You can't blame them much if you are not mixing your sand with a STANDARD MIXER.

It has four rows of paddles revolving 25 RPM that turn the sand four times per revolution, or 100 TIMES PER MINUTE.

The skilled shoveler with a screen could never approximate such mixing.

Ask for catalog and prices.

The Standard Sand & Machine Co.

5151 St. Clair Ave., N. E., Cleveland, Ohio

TO Manufacture Castings Economically USE

Machines No. 110 and No. 220
Jolt Rollover Squeeze Pattern Draw
Roller Bearings

MODERNS

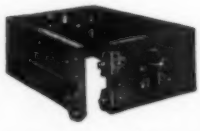
with

ARCADE

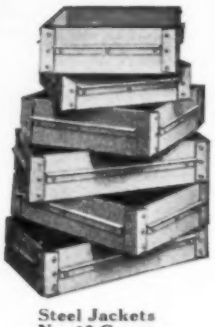
FLASK

and

JACKETS



Cherry Flasks
MILLED PINS
AND EARS

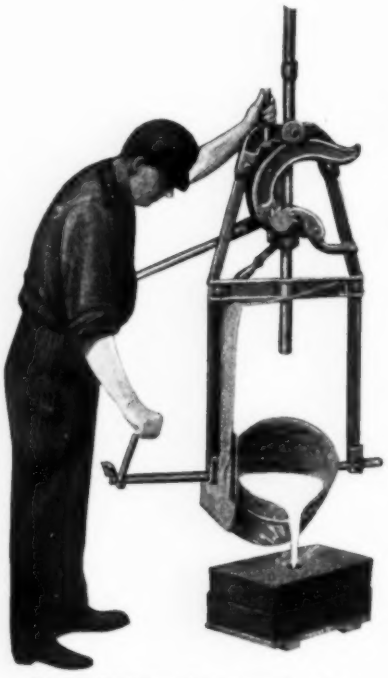


Steel Jackets
No. 10 Gauge
WELL BRACED

POUR WITH THE

No. 1 Brillion

Device



No. 1 Brillion Pouring Device
CRANES TOO.

AND

Clean

With

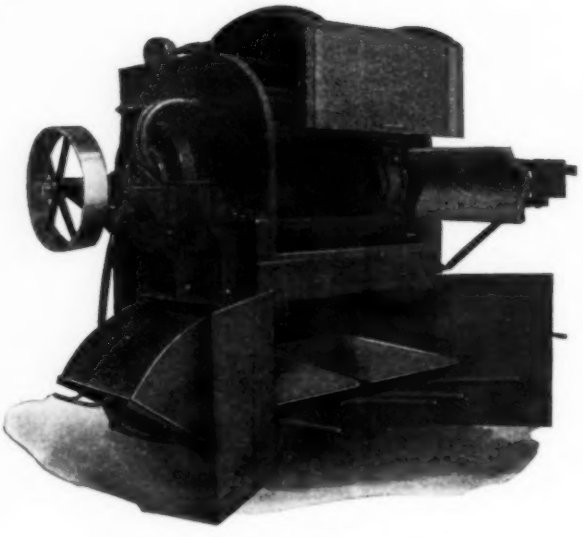
THE

ARCADE

SAND

Blast

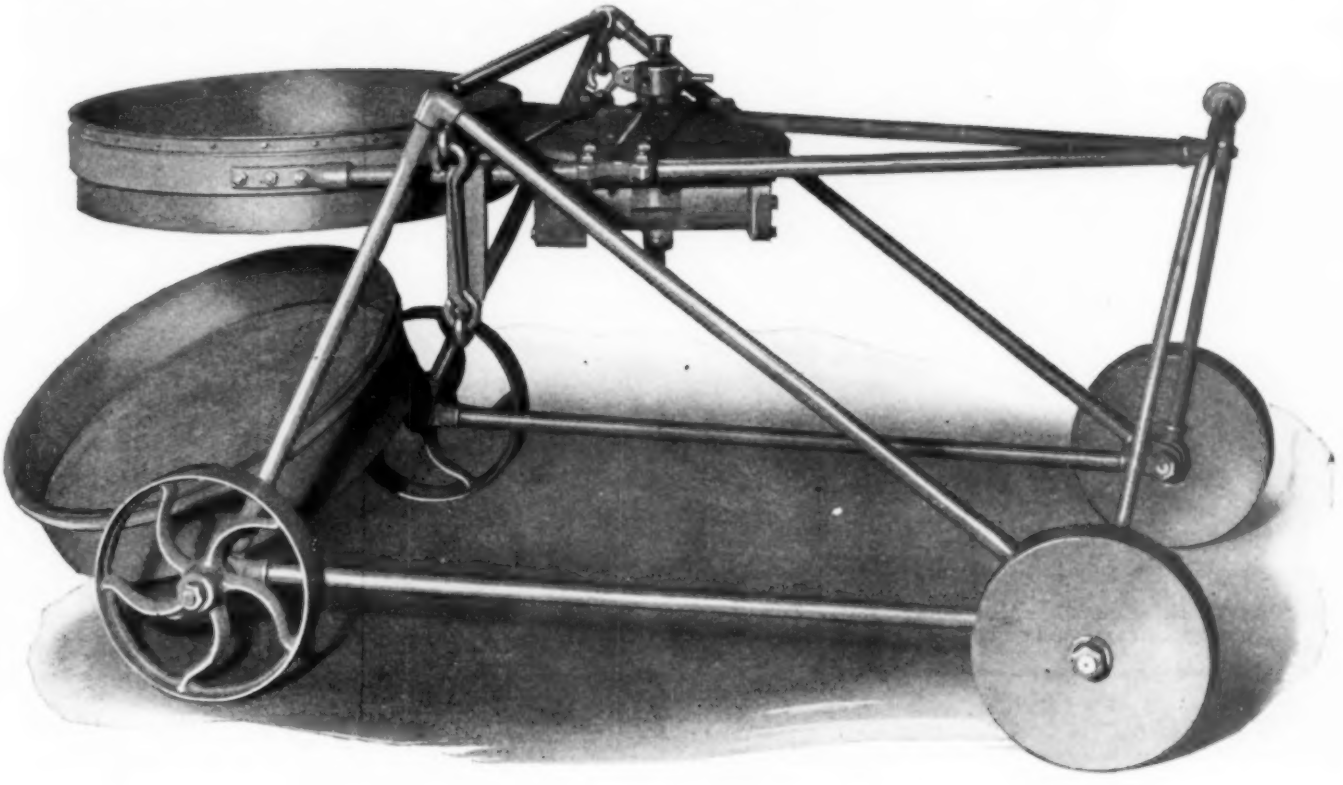
BARREL



ARCADE SAND BLAST BARREL

Arcade Manufacturing Company
Freeport, Illinois, U. S. A.

ARCADE MOLDING MACHINES AND FOUNDRY EQUIPMENT



Adams Pneumatic Sand Riddle

A strong, rugged machine, built to stand the hard knocks of daily foundry use.

A machine that piles up dividends for the user by resulting in lower labor costs and better sand preparation.

Construction

The framework is built entirely of pipe and special malleable fittings. It is exceptionally strong, yet so light that it can easily be moved about.

Two riddles, 24" in diameter, 5" deep, are furnished. Their all-metal construction insures permanence.

Riddles can be instantly removed from the machine. The screen is also removable, and can be replaced at slight cost.

Motive Power

The strong vibratory action of the Adams Pneumatic Sand Riddle is imparted by a simple air motor of distinctive design.

The double action cylinder and piston revolve around a stationary crank shaft.

The revolving element is greatly out of balance, and it shakes the riddle with a jerky circular motion, as a flywheel which was much out of ballance would shake the foundation of an engine.

This machine will straddle a sand heap, and may be easily moved without even shutting off the power. It will thoroughly mix facing, core sand, etc., and will deposit it in a cone form or in a row. It can also be used to riddle directly into a wheelbarrow, box or floor flask.

Ask for Supplement "C"

The Adams Company Est. 1883 — 170 Foster Street, DUBUQUE, IOWA, U.S.A.

An automobile spring bracket, cast in malleable iron. The photograph to the right shows a half day's run of finished molds for this casting. A Rapid Jolt Squeezer was used on this job.

JOLTING PRODUCTION UP — DEFECTIVES DOWN

Rapid Jolt Squeezer—a combination machine that will handle jobs beyond the range of plain squeezers. It can be operated as a plain squeezer or jolt without adjustment or alteration. Specifications — Diameter jolt piston 3 in., diameter squeezer piston 8¼ in., size of bench plate 14 x 21 in., vertical adjustment 14 in., shipping weight 800 lbs. The Jolt Squeezer is also made in the portable type.

There is a Rapid Plain Squeezer, both in the stationary and portable types, for the simpler jobs.

For flasks with a depth greater than 20 in. special adjustment can be made by raising entire head assembly. We suggest that you write for descriptive literature regarding these machines.

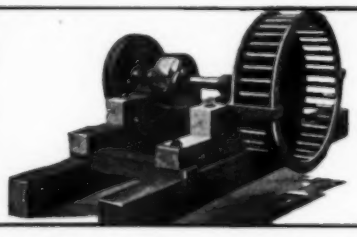
A match-plate, consisting of two patterns, is used for the casting pictured. With a Rapid Jolt Squeezer, one man turned out 900 molds on this job, in a five and half day week. Out of this high weekly production, but four—44/100 of one per cent of the total weekly run—were defective. To reduce imperfect molds to such a low percentage, and at the same time to maintain such a high production, effects a considerable reduction in molding costs.

Molding, with the Rapid Jolt Squeezer, can be easily standardized to "so many bumps." This reduces labor and supervision costs, speeds up production, and insures molds that are uniformly true to pattern.

FEDERAL MALLEABLE COMPANY
WEST ALLIS, WISCONSIN

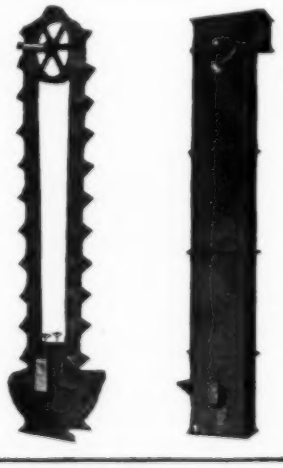
Rapid
MOLDING MACHINES
REG. U.S. PAT. OFF.

Overhead sand bins save time and money. The molder needs no shovel. Just a pull at a lever and the sand drops right into the flask.



This conditioner tempers, cuts and aerates sand better, quicker and cheaper than it can be done by hand.

Belt conveyors carry and distribute tempered sand quicker and cheaper than men with wheelbarrows.



Men cannot possibly lift sand as cheaply or as well as simple bucket elevators like these.

A REAL OPPORTUNITY of Bringing Down Your Costs

AN article by a well-known foundry engineer (Iron Age, Nov. 9, 1922) points out that 56 tons of material are handled in an automobile foundry to get out one ton of castings. In a bathtub foundry, according to the same engineer, 137 tons of material are handled for every ton of castings.

25 Per Cent Of This Material Is Sand

In the automobile foundry, 19 tons of the total 56 tons are sand. Of the 137 tons in the bathtub foundry, 33 tons are sand. Roughly speaking, then, sand represents one-fourth of the total amount of material that is handled. Analyze your own foundry and you will find that the same condition exists.

Here Lies A Real Opportunity Of Bringing Down Your Costs

When you turn the sand handling part of your work over to machines instead of men you take one man in every four out of your material handling gang. One-fourth less handling labor goes into your castings. Your costs are that much lower.

This Idea Is Not Nearly As New As It Sounds

Many foundrymen have taken advantage of this opportunity for years. There are hundreds of low cost foundries throughout the country who get their costs down in just this way, and there is no reason why you should not get the same savings that they are getting.

To Show You How It Is Done

About a year ago we sent a man into ten typical foundries using mechanical sand handling equipment, to bring back photographs showing their method of operation. These photographs and a little essential explanatory matter have been made up into bulletin 49.

This bulletin contains much of value to any man who is interested in the operation and construction of foundries. It will show you just how other foundries are bringing down their costs by handling sand with machines instead of men.

Just write and ask for bulletin 49. A copy will be sent you by return mail.

THE C. O. BARTLETT & SNOW CO.
MAIN OFFICE AND WORKS: CLEVELAND, OHIO

FLINT SHOT
TRADE MARK—REGISTERED

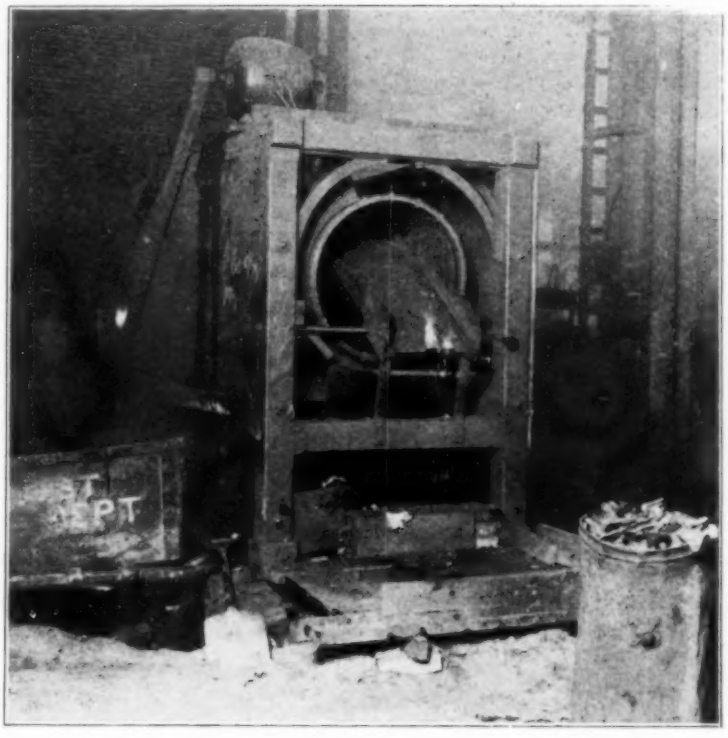
AUTHORITY

Our new book *"Sandblasting Up To Date"* discusses the scientific and practical side of sandblasting in a helpful way.

It includes records and microphotographs of authoritative disinterested tests made over a 5-months period by the Stoney Foundry Engineering & Equipment Co. of Cleveland.

Send for a copy of this book for each of your purchasing and operating executors.

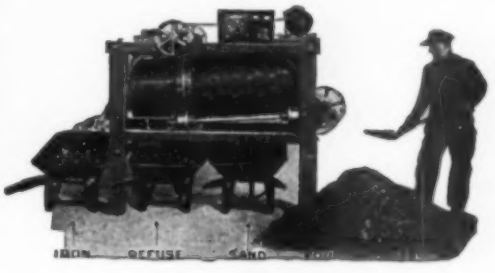
UNITED STATES SILICA CO.
122 South Michigan Ave. Chicago



for iron recovery—

Two views showing Dings Magnetic Separators reclaiming iron from coke and slag.

The view below shows how the Dings Type O handles iron, sand and refuse.

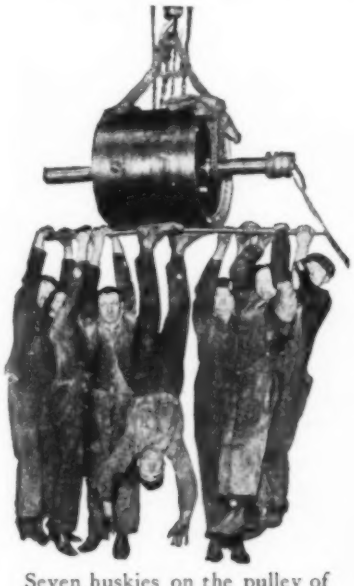


Dings Separators.....

will save you from 20 to 25% on current consumption alone

These plants are among the many using Dings Separators

Allis-Chalmers
Ford Motor Co.
Duriron Casting Co.
American Steel Foundries
International Harvester Co.
Link Belt Company
National Malleable Casting Co.



Seven huskies on the pulley of a Dings—it will hold more but there wasn't room. No other pulley has proved such ability.

DINGS "High Intensity" Magnetic separators have demonstrated in service that they will easily save their initial cost through the reduction in current consumption made possible by Dings design.

DINGS MAGNETIC SEPARATOR CO.
6[illegible] Smith Street, Milwaukee, Wisconsin

Dings High Intensity MAGNETIC SEPARATION

BIRMINGHAM
513 N. 21st St.
BUFFALO, N. Y.
988 Ellicott Square
CHICAGO
115 S. Dearborn St.
CINCINNATI
Mercantile Library Bldg.
CLEVELAND
Leader-News Bldg.
DENVER
1718 California St.
DETROIT
805 Hammond Bldg.
LOS ANGELES
San Fernando Bldg.
NEW YORK
52 Vanderbilt Ave.
PITTSBURGH
1522 Oliver Bldg.
RICHMOND
2106 E. Main St.
SALT LAKE CITY
201 Dooly Block
SAN FRANCISCO
419 Call Bldg.
ST. LOUIS
611 Granite Bldg.

Please send us the foundry bulletin—free

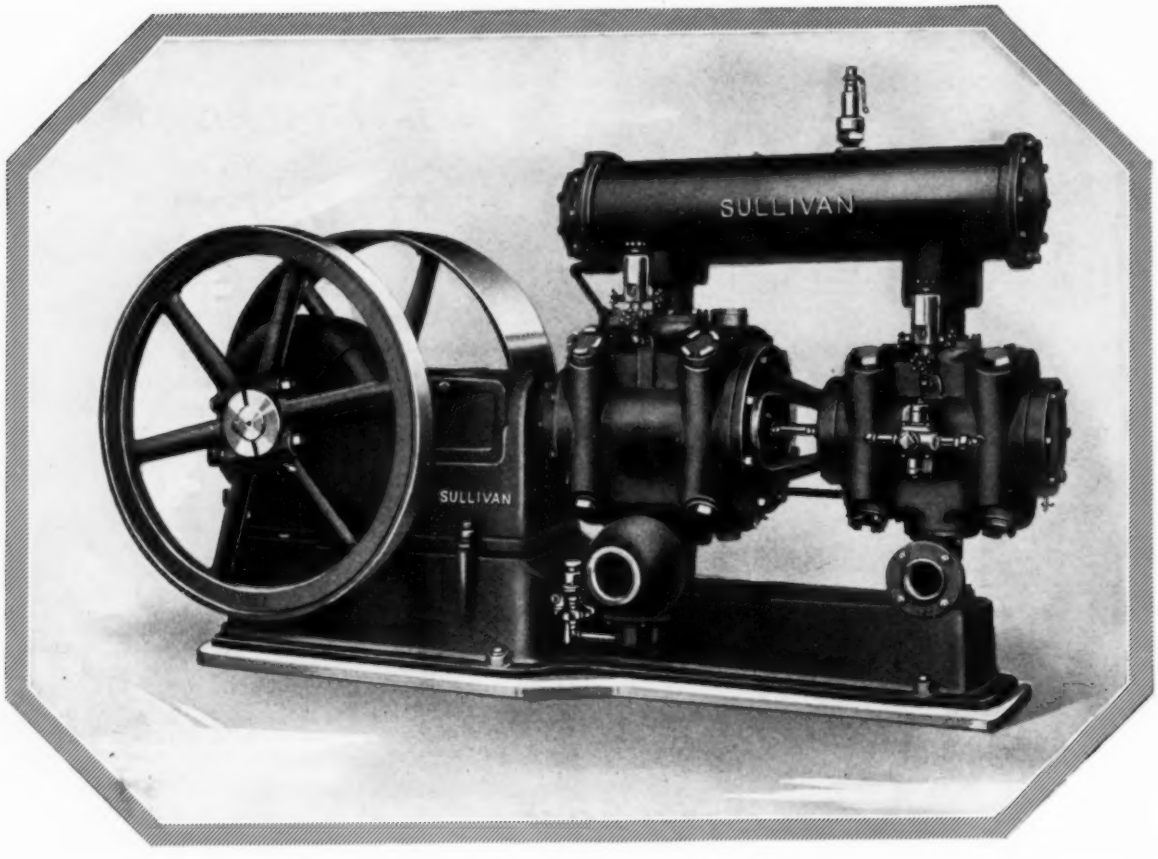
Firm.....

Address.....

Att'n.....

To Dings Magnetic Separator Co.
675 Smith St.
Milwaukee, Wis.

F12-15S-RTG



A Useful Foundry Compressor

Sullivan "WH-6" Two Stage, Belted

Size, service and price combine to render these Sullivan "WH-6" compressors a desirable investment for many shops or foundries.

Two sizes, 340 and 445 cu. ft. are available, both units of convenient capacity for numerous plants; requiring 59 and 78 H.P. respectively for 100 lb. air pressure.

"WH-6" compressors follow the popular "WG-6", single stage design, employing "wafer" automatic air valves, splash lubrication and tight enclosure of working parts.

But the air is compressed in two stages, with a large aluminum tube intercooler, thus distributing the load more evenly and reducing the H.P. input.

"WH-6" compressors embody the Sullivan unloading system. This requires operation at either full load or at no load, the two most economical points in the cycle. It consists of a total closure unloading device on the air intake, complemented by an atmospheric relief valve which relieves the high pressure cylinder of all work when compression stops.

The power inflow to the compressor is smooth and even at all times.

The simplicity of the design and standardization of parts and sizes, permit the "WH-6" compressors to be very moderately priced.

In the "WH-6" you will secure a modern, efficient well built compressor, at low first cost.

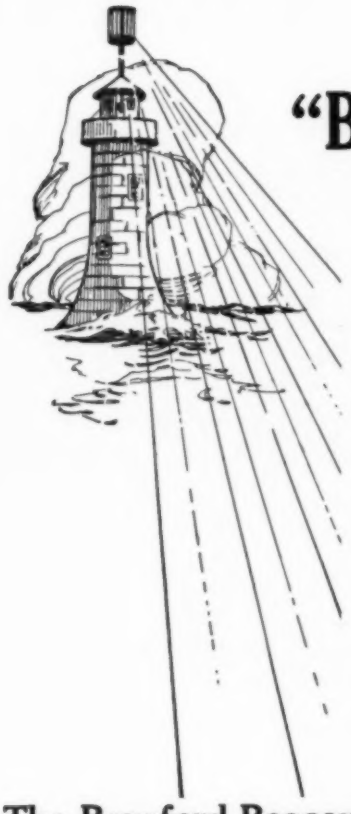
Shall we send new Bulletin No. 1877-K?

DOMESTIC SALES OFFICES
Birmingham, Boston, Butte, Claremont, N. H., Cleveland, Dallas, Denver, Duluth, El Paso, Huntington, W. Va., Joplin, Juneau, Knoxville, New York, Pittsburgh, St. Louis, Salt Lake, San Francisco Spokane.

COMPRESSORS AIR LIFT DIAMOND DRILLS SHARPENERS FORGES
FORGE HAMMERS COAL CUTTERS ROCK DRILLS DRILLING CONTRACTORS

SULLIVAN
MACHINERY COMPANY
146 So. Michigan Ave. Chicago.

FOREIGN SALES OFFICES
Algiers, Brussels, Calcutta, Christiania, Durban, Natal, Havana, Lima, London, Madrid, Mexico City, Paris, San Juan, Santiago, Shanghai, Sydney, N. S. W., Tokyo, Toronto, Tunis, Turin, Vancouver.



The "Branford" Vibrator Pot Rapper

The Branford Beacon Discloses——————

Do away with the destructive maul and install the Branford Vibrator Pot Rapper.

Write us for prices giving size of your pots.

State whether flanged or plain.

Note the smile on Alex's face since he has laid aside the maul and used the BRANFORD VIBRATOR POT RAPPER.

The BRANFORD VIBRATOR POT RAPPER cuts costs in your annealing department, fragile castings can be shovelled in "not placed by hand"—is adapted for all classes of packing from sand to scale. Improves sand packing.

Do away with the destructive maul and install the

BRANFORD VIBRATOR POT RAPPER

Made in three sizes:

2" for 16" x 20" pot 2½" for 24" x 30" pot 3" for 36" x 48" pot

MALLEABLE IRON FITTINGS CO.,

BRANFORD, CONN., U. S. A.

DISTRIBUTORS

Buckeye Products Co., Cincinnati; Carpenter Bros., Milwaukee, Wis.; F. A. Coleman, Cleveland, Ohio; Combined Sup. & Equip. Co., Buffalo, N. Y.; Dominion Fdy. Sup. Co., Montreal, Que., Canada; Toronto, Ont., Canada; Donald Sales & Mfg. Co., Milwaukee, Wis.; Federal Foundry Supply Co., Milwaukee, Wis.; Federal Steel Co., Detroit, Mich.; Freeman Supply Co., Toledo, Ohio; Hill & Griffith Co., Chicago, Cincinnati, Birmingham, Ala.; T. P. Kelly & Co., Chicago, New York, Worcester; J. S. McCormick Co., Pittsburgh, Pa.; Mineral Supply Co., Chicago, Ill.; Moline Sales Co., Moline, Ill.; N. Y. Sand & Facing Co., Brooklyn, N. Y.; Nixon-Hasselle Co., Chattanooga, Tenn.; S. Obermayer Co., Chicago and branches; J. W. Paxson, Phila., Pa., Providence, R. I.; Rochester-Osborn Co., Rochester, N. Y.; J. J. Shannon & Co., Phila., Pa.; Snow & Galgiani, San Francisco, Calif.; Snyder Fdy. Supply Co., 2434 E. 57th St., Los Angeles, Calif.; F. B. Stevens, Detroit and branches; R. J. Teetor Co., Muskegon, Mich.; Whitehead Bros. Co., Buffalo, New York, Providence, R. I.; E. J. Woodison, Detroit and branches.

Christmas Gifts that your friends will appreciate

What else can you give a friend for so little money that will be as welcome and as valuable to him as a practical book about his kind of work—a gift that will help him to increase his knowledge and his earnings—a gift that will be used and appreciated for years.

Everyone is always glad to get a gift like that. And a good book costs the giver no more than some little gimcrack that's here today and forgotten tomorrow. This Christmas, why not give your friends helpful books?

Here are a few suggestions

Please bear in mind that these are just a few selections from a complete stock covering all branches of foundry practice, and that we can furnish books on any technical subject. Complete catalogue will be sent gladly on request.

For the Brass Foundryman—

"Metals and Their Alloys" by Charles Vickers
760 pages—Price $7.50

A thoroughly practical book describing the latest and best American methods of mixing, melting and casting all kinds of non-ferrous metals. A brand new up-to-date work, published 1923.

For the Malleable Foundryman—

"American Malleable Cast Iron" by H.A.Schwartz
416 pages—Price $7.00

The only book in print on the making of malleable castings. Covers melting, fuels, furnaces, molding, pattern making, annealing, cleaning, inspecting, testing, metallography and properties. A complete encyclopedia of malleable practice.

For the Steel Foundryman—

"The Steel Foundry" by John Howe Hall
334 pages—Price $4.00

Covers the metallurgy and production of all classes of steel castings. It gives the details of the various steel making processes and shows the relative cost of installation and quality of steel produced, covers all phases of foundry procedure such as molding, pouring, annealing, etc.

For the Gray Iron Foundryman—

"Principles of Iron Founding" by Dr. Richard Moldenke
517 pages—Price $5.00

A comprehensive treatise on the basic principles underlying the best modern foundry practice. The book does not contain a string of formulas which have long become obsolete, or carbon diagrams which are interesting but useless to the foundryman; but goes into the practical every-day problems of the foundryman and shows him how to overcome them.

For the Pattern Maker—

"Pattern Making"—Richey
232 pages—Price $1.50

Shows the reader how to take the blueprint and from it make the pattern for any kind of castings under any condition. The allowances for a shrinkage, draft and finish are explained. Simple and built-up patterns of all kinds are clearly treated. Various special cases are taken up, cranks, pipe connections, valves, etc.

For ALL Foundrymen—

"The Foundryman's Handbook"
309 Pages—Price $5.00

This book is a compilation of the famous "Data Sheets" which have been published in THE FOUNDRY for many years and is a digest of all the rules and formulas governing modern foundry operations. It contains practical information that is essential to the foundryman, pattern maker, metallurgist and student and much of it has never been printed anywhere else. The book is arranged and cross-indexed in such a way that subjects are easily found.

Prices include delivery postpaid anywhere in North America
For other countries, add 25c for each book

THE PENTON PUBLISHING CO.,
Penton Bldg., Lakeside Ave. & W. 3rd St.,
Cleveland, Ohio

Date.....

Enclosed is $..... for which you are to send the following books to the addresses indicated. You are to ship them so that they will be delivered a day or two before Christmas, and enclose with each a Christmas card showing that the gift is from me.

My Name and Address.....

Send.....to.....

.....

Send.....to.....

.....

Send.....to.....

.....

142IF

American Radiator Company, Says:

"The battery of six ovens that we have had in operation for three years, has given us wonderful results. It is nothing short of miraculous the amount of work we have been able to handle with this unit."

Typical Battery of Coleman Rolling Drawer Core Ovens. Nine separate installations with a total of twenty-eight ovens have been furnished **American Radiator Company and associated companies.**

A Few Other Users of Coleman Ovens

Allis-Chalmers Mfg. Co.
American Foundry Co.
American Radiator Co.
Belle City Malleable Iron Co.
Buick Motor Co.
Burnham Boiler Corp.
Cadillac Motor Car Co.
Cramp Ship Yards & Engine Co.
Fairbanks, Morse & Co.
Falk Corporation
Frick Co., Inc.
Fulton Iron Works
General Electric Co.
Gisholt Machine Co.
International Harvester Co.
Lewis Foundry & Machine Co.
Lorain Steel Co.
Lycoming Motors Corp.
H. Mueller Mfg. Co.
Norfolk & Western R. R.
Norfolk Navy Yard
Otis Elevator Co.
Otis Steel Co.
Pawling & Harnischfeger Co.
Philadelphia Navy Yard
Power Specialty Co.
Pratt & Cady Co.
Pratt & Letchworth Co.
Stearns Motor Mfg. Co.
U. S. Malleable Iron Co.
Union Steam Pump Co.
Westinghouse Electric & Mfg. Co.
Whitin Machine Works
Wolverine Brass Works
Wolff Mfg. Corporation
Worthington Pump & Machinery Corp.

Any Type—
Portable Rack Ovens
Rolling Drawer Ovens
Car Type Ovens
Shelf Ovens
Conveyor Ovens
Special Ovens
In Any Combination

Any Fuel—
Coke, Coal,
Oil, Gas,
Powdered Coal
Electric, etc.

Any Size—
To Suit All
Core Room
and Foundry
Conditions

COLEMAN
CORE AND MOLD OVENS

Twenty years of practical experience, plus the knowledge gained in building hundreds of successful foundry ovens, assure the utmost satisfaction in every installation of genuine Coleman Ovens.

Exclusive patented features provide an efficiency in operation not available in any other type of oven construction.

Every installation is fully guaranteed in every respect.

Write today for complete Coleman Oven Catalog 22

The Foundry Equipment Co.

Builders of Coleman Ovens and Furnaces

1831 Columbus Road, N.W. CLEVELAND, OHIO

SPENCER TURBO-COMPRESSORS

Control of Air Guarantees Uniform Results

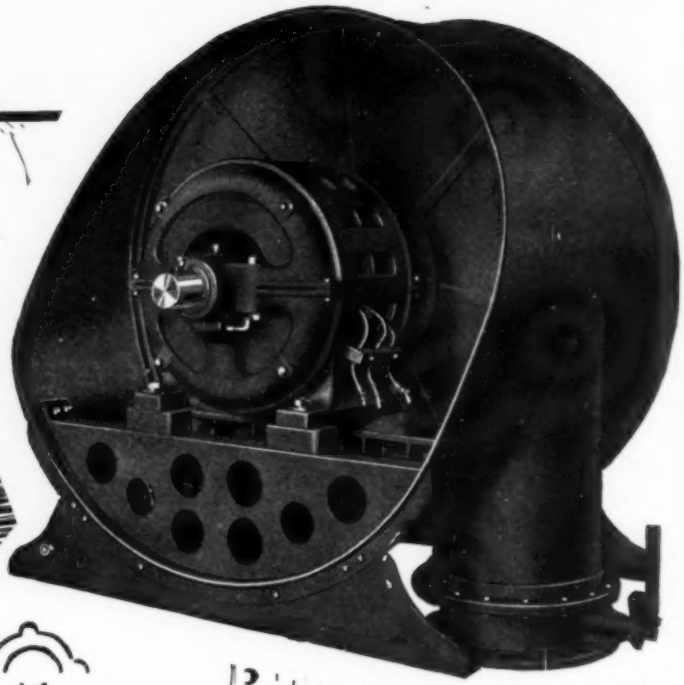
The easy and convenient regulation of both volume and pressure give the operator absolute control over the air supply, which results in high grade castings throughout the *entire* cupola run.

However, the *quality of service* is not the only good reason for using Spencer Turbo-Compressors; the *length of service* and *low operating costs* are other factors that make Spencer equipment a very profitable investment.

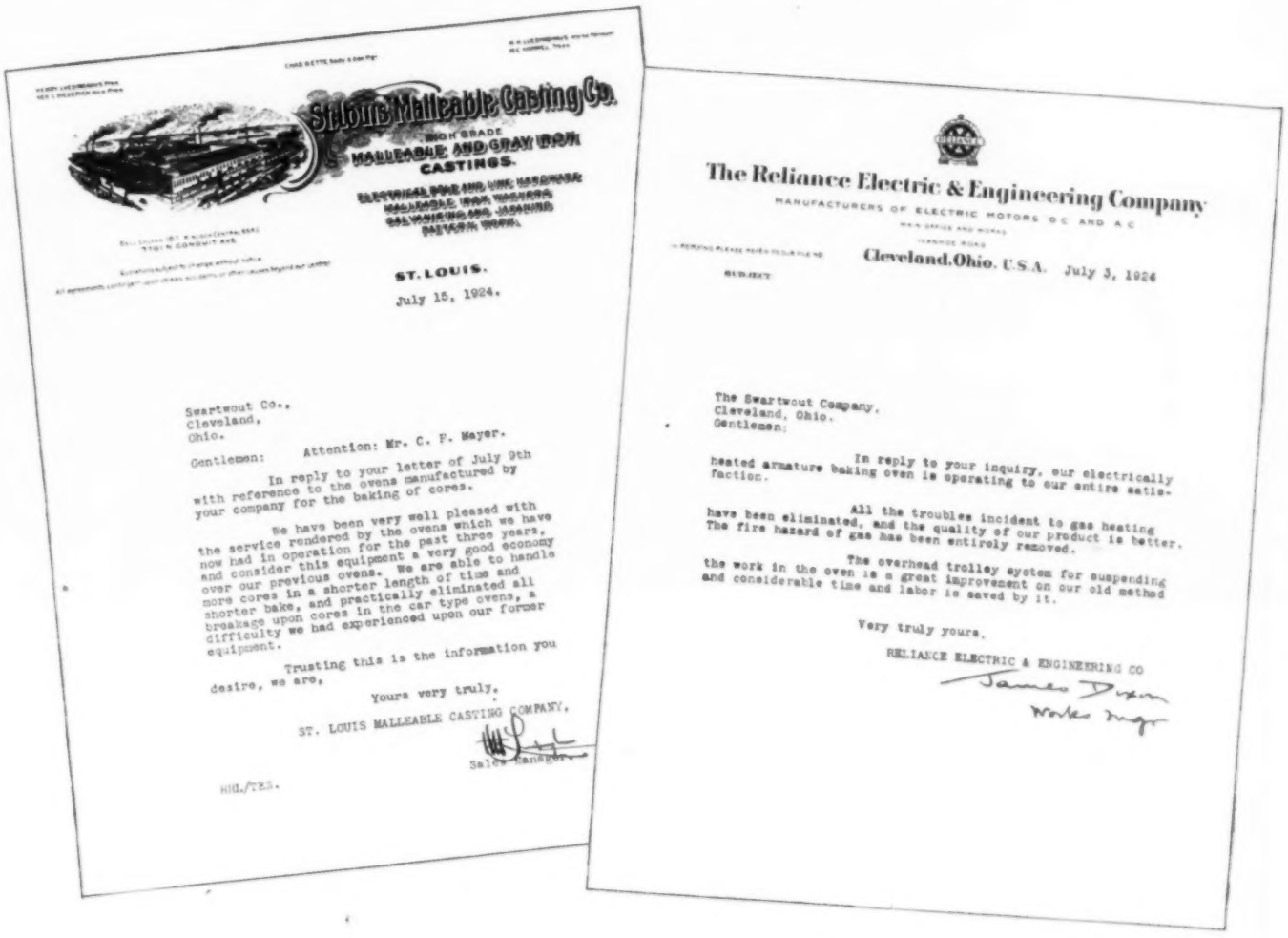
Low speed. No moving parts in contact. No pulsations or surging.

Investigate! Write for full details.

The Spencer Turbine Company
HARTFORD, CONN.



These Letters Tell Stories of Complete Oven Satisfaction!



St. Louis Malleable Casting Co.
HIGH GRADE
MALLEABLE AND GRAY IRON
CASTINGS.

ST. LOUIS.
July 15, 1924.

Swartwout Co.,
Cleveland,
Ohio.

Gentlemen: Attention: Mr. C. F. Meyer.

In reply to your letter of July 9th with reference to the ovens manufactured by your company for the baking of cores.

We have been very well pleased with the service rendered by the ovens which we have now had in operation for the past three years, and consider this equipment a very good economy over our previous ovens. We are able to handle more cores in a shorter length of time and shorter bake, and practically eliminated all breakage upon cores in the car type ovens, a difficulty we had experienced upon our former equipment.

Trusting this is the information you desire, we are,

Yours very truly,

ST. LOUIS MALLEABLE CASTING COMPANY,

Sales Manager.

HHL/TES.

The Reliance Electric & Engineering Company
MANUFACTURERS OF ELECTRIC MOTORS D C AND A C

Cleveland, Ohio, U.S.A. July 3, 1924

The Swartwout Company,
Cleveland, Ohio.
Gentlemen:

In reply to your inquiry, our electrically heated armature baking oven is operating to our entire satisfaction.

All the troubles incident to gas heating have been eliminated, and the quality of our product is better. The fire hazard of gas has been entirely removed.

The overhead trolley system for suspending the work in the oven is a great improvement on our old method and considerable time and labor is saved by it.

Very truly yours,

RELIANCE ELECTRIC & ENGINEERING CO

James Dixon

Works Mgr.

One letter is from a user of Swartwout Core Ovens. The other is written by an electrical manufacturer using Swartwout Ovens for armature baking. Both letters are alike in praising Swartwout Oven performance—mentioning such vital considerations as speed, economy, and improved quality of product.

Such experiences are being duplicated by the use of Swartwout Ovens in hundreds of plants the country over. They can be duplicated in *your* plant. The advice of our engineers on your particular problem is yours for the asking.

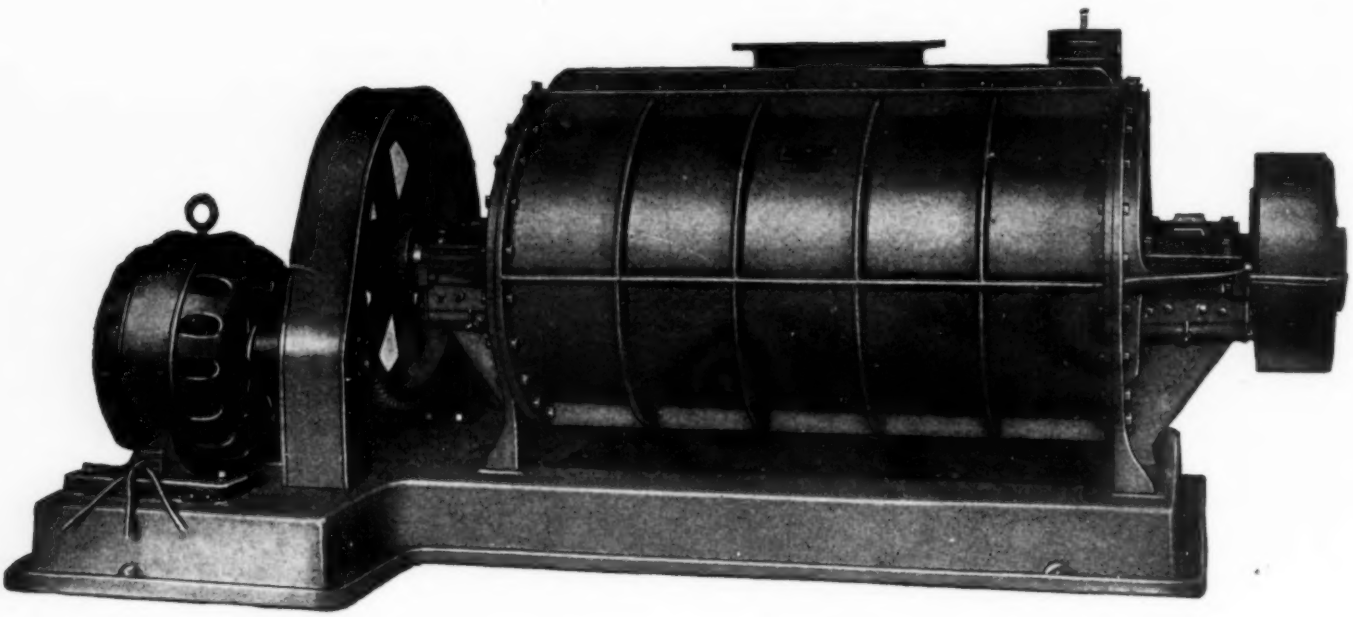
The Swartwout Company

General Offices: 18531 Euclid Ave., Cleveland, Ohio
Factories: Cleveland, O., Orrville, O.

Swartwout
Industrial Ovens

Increased Cupola Capacity!

In some places the capacity of the cupola has been increased several tons an hour by replacing a Fan with a Roots Rotary Positive Blower. This suggests an enormous saving.



Gauged Air! Positively Delivered!

Measured Air! Uniform Air! Only such air should be fed to your cupola. This is where Roots Rotary Positive Blowers prove their mettle—they assure uniform temperature and quality of iron; they overcome resistance, oxidation and eliminate the cause of sluggish iron; they increase cupola capacity, and at the same time their cost of operation is unusually low.

Let us tell you all about the "ROOTS".
Write for catalog.

The P.H.&F.M. ROOTS CO.

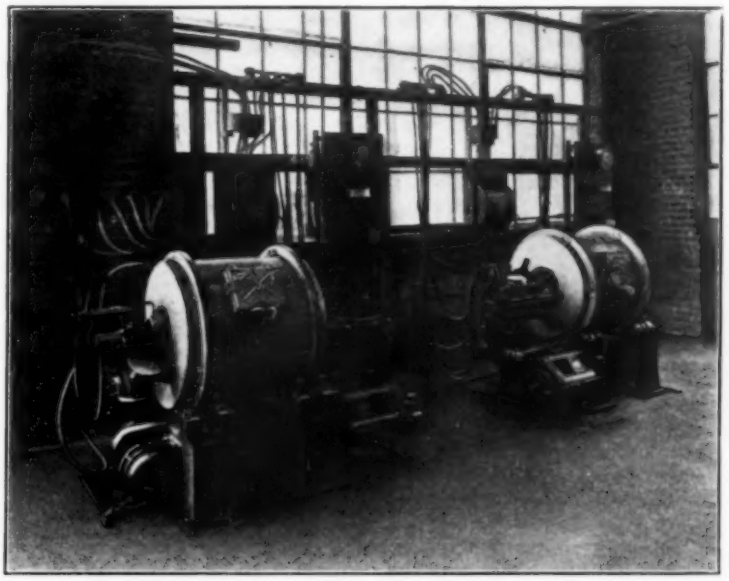
DEPT. 42
CONNERSVILLE, IND.

Chicago Office
122 S. Michigan Ave.

New York Office
Room 802-120 Liberty St.

Cleveland Office, 1576 Union Trust Bldg.

ROOTS
ROTARY POSITIVE BLOWERS
GAS EXHAUSTERS
PUMPS AND VACUUM PUMPS
FLEXIBLE COUPLINGS
BLAST GATES
RELIEF VALVES
FEED DEVICES
GOVERNORS
PRODUCTS



TO ALL FOUNDRYMEN!

From conversations we had, with the leading representatives at the Milwaukee Foundry Convention last October, we are confident that Detroit Electric Brass Furnaces offer to the men in the brass melting field a unit that foundrymen recognize as a real time and money saver.

The enthusiastic satisfaction expressed by everyone who visited our exhibit, both in our furnace and the castings, ingots and billets poured from our furnaces by users throughout the country, leads us to believe that you will find the complete story on Detroit Electric Furnaces a very interesting one.

Detroit Electric Furnaces are the leaders in the brass melting field. Their popularity is well deserved due to the high efficiency obtainable, lower metal losses and the perfect mixing of the metal by the rocking action.

Producing a superior quality of product while speeding up its rate of production and reducing melting costs by an average of $10.00 per ton of metal melted, we know we can offer you such savings and improvements as to make your present methods wasteful and extravagant in the extreme.

All the facilities which we possess in the way of data, information and personal service are at your disposal by writing to us at the address below.

ASK FOR BULLETIN 32.

DETROIT ELECTRIC FURNACE COMPANY

2332 FIRST NATIONAL BANK BLDG.

DETROIT **MICHIGAN**

From Stove Parts to Sword Blades

IN all sorts of polishing shops on all sorts of work the demand is always for a clean, sharp, fast-cutting grain that holds to the set-up wheel—in other words, a grain like

ALOXITE T. N. F.

THE GRAIN THAT HOLDS WHILE IT CUTS
WHILE IT POLISHES

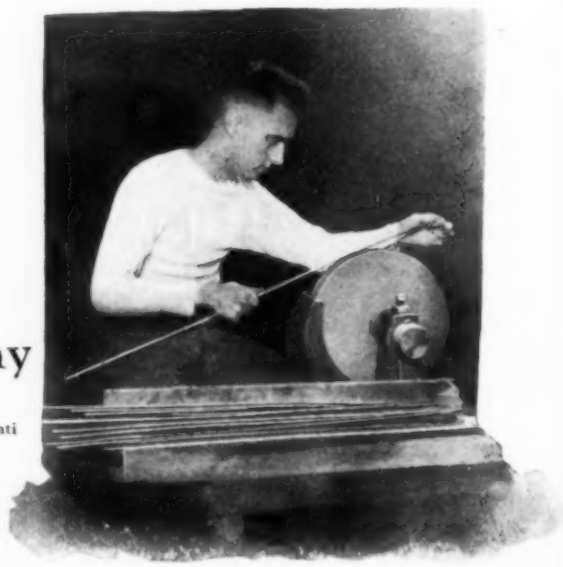
ALOXITE T. N. F. has just the right toughness or temper. It doesn't crush down and waste itself by powdering off the wheel.

It is an economical grain because it does full duty—gives a full service before wearing down.

Aloxite T. N. F. always gives a smooth, uniform finish because it is absolutely uniformly graded. It runs true to grit size.

Another thing to remember is that Aloxite T. N. F. presents such an irregular grain surface that it has greater glue adhesion, therefore it always holds to the wheel.

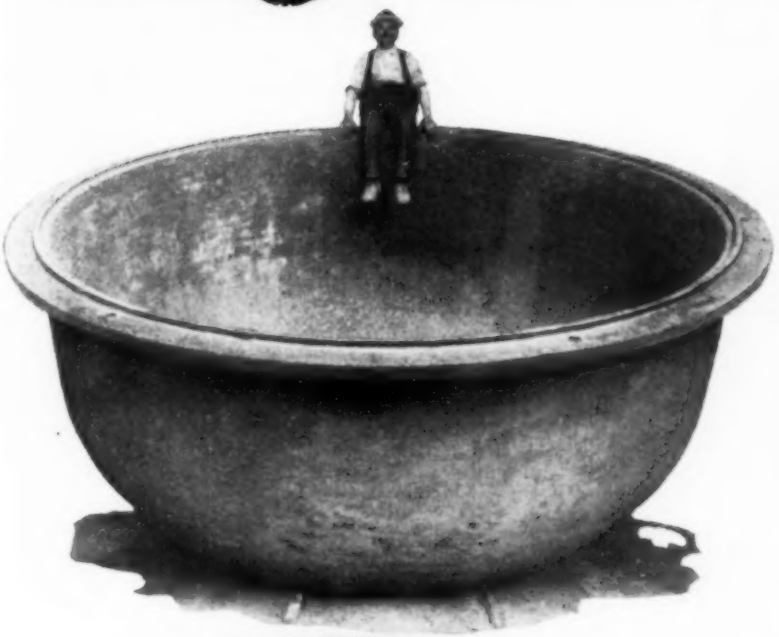
Suppose You Write For Samples
In Any Grit You Desire



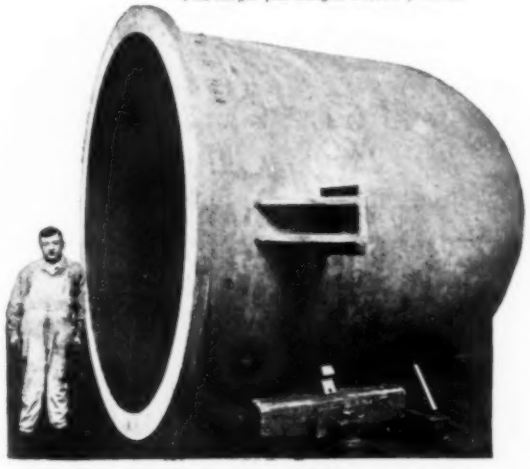
The Carborundum Company
Niagara Falls, N. Y., U. S. A.
New York, Chicago, Boston, Philadelphia, Cleveland, Detroit, Cincinnati
Pittsburgh, Milwaukee, Grand Rapids
Canadian Carborundum Company, Limited, Niagara Falls, Ont.

TRADE MARK

Mayari Pig Iron



Caustic Pots made with Mayari Pig Iron in the mixture
The larger pot weighs 36,000 pounds



Nitric Acid Retort, weight, 63,000 pounds. Made with 20% of Mayari in the mixture

Castings for the Chemical Industry

THE specifications covering the requirements of castings for the chemical industry are severe insofar as they demand a metal which must be sufficiently hard to resist the chemical action of acids and alkalis, and yet be machineable.

Mayari Pig Iron is the only pig iron which contains the elements Nickel and Chromium in their natural states.

The improvement in the quality of high grade castings due to the use of Mayari Pig Iron in the mixture, has resulted in its adoption in making castings for Caustic pots, Nitric acid retorts, and other castings requiring an acid-and-alkali-resisting metal, and which in addition resists oxidation under heat conditions.

The use of Mayari Iron with the proper proportion of other raw materials in the mixture, produces clean, fluid metal with long life in the ladles, eliminates blow-holes, pin holes and segregation. It closes the grain and increases the strength and toughness, thus giving greater durability and resistance to wear.

Our foundry experts will be glad to confer with you regarding the application of Mayari Pig Iron to your individual casting problems.

BETHLEHEM STEEL COMPANY
General Offices: **BETHLEHEM, PA.**

Sales Offices:

New York	Cunard Building	Atlanta	Healey Building
Boston	Oliver Building	Detroit	Penobscott Building
Philadelphia	Widener Building	Cincinnati	Union Trust Building
Cleveland	Union Trust Building	Buffalo	Marine Trust Building
St. Louis	Chemical Building	Pittsburgh	Oliver Building
Baltimore	Continental Building	Chicago	Peoples Gas Building
Washington	Wilkins Building	San Francisco	Matson Building

BETHLEHEM STEEL EXPORT CORPORATION
25 BROADWAY, NEW YORK CITY

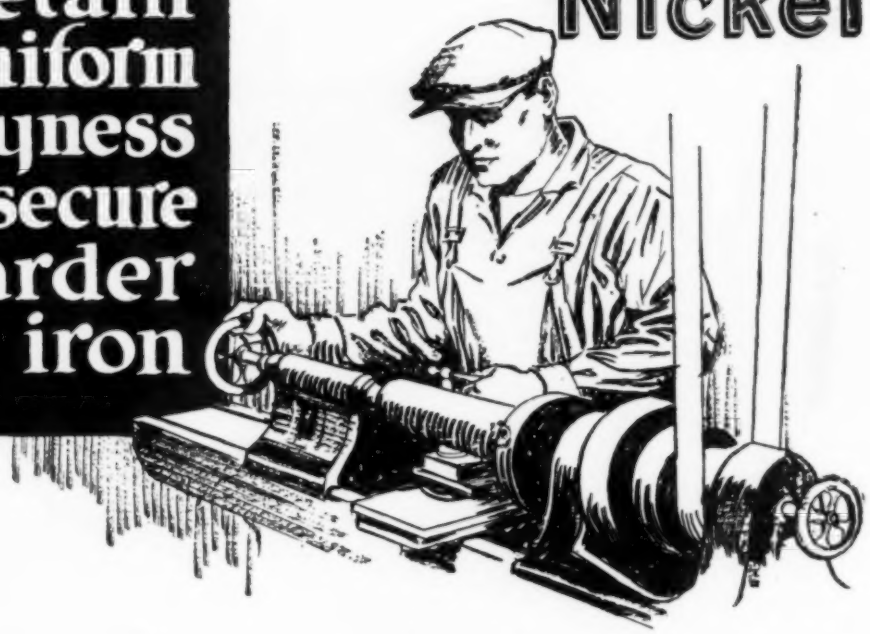
Sole Exporter of Our Commercial Products

BETHLEHEM

Cast Iron problem No. 4

To retain a uniform grayness and secure a harder cast iron

Answer ~ Add Grade F Nickel



Nickel helps make a superior foundry product

If it were only a question of making hard cast iron! The answer to that question is common knowledge.

But to make it hard and long wearing, and at the same time keep it easily machinable, presents a problem that foundries are just beginning to solve satisfactorily.

The answer is the addition of Grade F Nickel —either in the crucible or the cupola.

For Nickel Cast Iron possesses a rare combination of advantages, summed up in the following five points of superiority.

1. Greater toughness and wearability,
2. Increased hardness and less brittleness,
3. More uniform grayness, with consequent increased wearability,
4. A finer, closer grain which holds down machining costs,
5. Increased resistance to hydrostatic pressures.

Make your castings worthy of the name they bear. Start adding Grade F Nickel now. Write for further information.

SEND FOR "LIST B" OF AVAILABLE LITERATURE

INCo Nickel

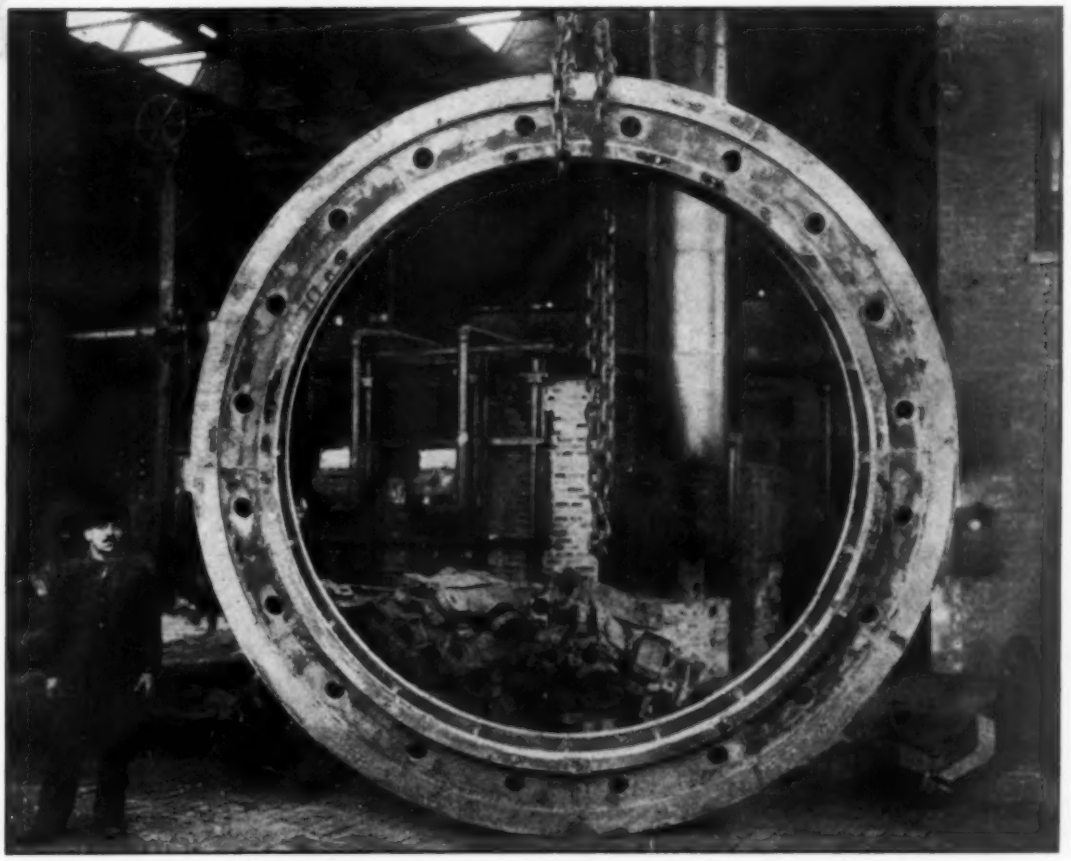
THE INTERNATIONAL NICKEL COMPANY, 67 WALL STREET, NEW YORK CITY.

FERRO CARBON TITANIUM Reg. U.S. Pat. Office Trade Mark F.C.T.

MAKING GOOD STEEL BETTER

FERRO CARBON TITANIUM Reg. U.S. Pat. Office Trade Mark F.C.T.

No. 24



THE NATIONAL STEEL FOUNDRIES
Milwaukee, Wis.
regularly use

FERRO CARBON-TITANIUM

to insure uniformly high quality in their CASTINGS

The Titanium Alloy Mfg. Co.

General Office and Works: NIAGARA FALLS, N. Y.

New York Office
94 Fulton St.

Pittsburgh Office
Oliver Bldg.

Chicago Office
Peoples Gas Bldg.

Agents for Great Britain and Europe: T. Rowlands & Co., Ltd., Sheffield, England.

Horse Head Slab Zinc is always uniform and always pure. Its use in brass, in Zinc base die castings and for wire galvanizing permits close factory control without loss of time; it reduces rejections.

The New Jersey Zinc Company

Established 1848

Products Distributed by

The New Jersey Zinc Sales Company

(INCORPORATED)

NEW YORK · CHICAGO · PITTSBURGH · CLEVELAND · SAN FRANCISCO

New Jersey zinc

Unloads Pig or Scrap Iron much cheaper than the steam-cranes.

The P & H can be moved readily.

Can do work that could not be accomplished at all with cranes on tracks.

10

INDUSTRIAL HANDLING *September, 1924*

Tractor Crane Repays Cost in Year

By P. W. Reck

Master Mechanic, The Bettendorf Company, Bettendorf, Iowa

THIS company has derived a great deal of satisfaction from the installation, some time ago, of a "crawler" type of tractor crane, a machine which propels itself over any kind of footing, regardless of obstacles, like an army "tank."

We have been using this piece of equipment on the difficult job of excavating ground for a tunnel 7 by 7 ft. and about 900 ft. long, to be used for power transmission lines. In this work alone we estimate that the crane paid one-half of its cost in the first six months of use.

As we also have and use three 15-ton steam cranes of the locomotive type, we are able to make some interesting performance comparisons. We find that we can unload pig or scrap iron much cheaper with the tractor crane than with the steam machines. The tractor outfit can readily be moved to either side of a car, completely unloading it in short order, whereas the steam cranes have to get first on one end of the car and then on the other because their booms are not full car length.

The fact that the tractor crane can be used anywhere in or about the plant, track or no track, is also a great advantage. As work can thus be done that could not be accomplished at all with track cranes.

The Bettendorf Company's crawler-type tractor crane, which repaid half its cost in six months on excavating work alone. It is seen here handling pig iron with a lifting magnet.

The P & H is driven by gasoline or electric motor. It is ready for work at a moment's notice—and when not needed—whether for 30 minutes or 3 hours it can be as readily shut down. No fuel is wasted.

The operator has instant control of crane travel, hoisting and swing through a full circle. He can locate his P & H at either side or end of cars or material stock piles. Like P & H Electric Traveling Cranes and Hoists, P & H Corduroy Cranes provide dependable, economical service with low maintenance costs.

Let us mail our Bulletin 40-X to you.
Excavating Machinery Division.

PAWLING & HARNISCHFEGER CO.

Established 1884
3805 National Ave., Milwaukee, Wis.

New York	Chicago	Philadelphia
Atlanta	Portland	Pittsburgh
Detroit	Memphis	Los Angeles
Kansas City	Dallas	San Francisco
	Seattle	

Warehouses and Service Stations:
New York Memphis San Francisco

P&H CORDUROY CRANES

Some Reasons Why *Your* Offices Should Be In *This* Building

The New PENTON BUILDING

A Modern, Comfortable and Well Located Home For Your Business

1. ***Excellent Location***
   3 Blocks from Public Square, 1 Block from Court House, 3 Blocks from Union Depot, Directly on Union Depot car line.
2. ***Low Rent***
   Right in the business section, but just outside of the high rent zones. Strictly up-to-date offices at "loft" prices.
3. ***Low Insurance Rates***
   Built completely fireproof throughout. Automatic Sprinkler System.
4. ***Daylight Building***
   "U" shaped construction, almost completely covered with windows. No spot in entire building more than 20 ft. from a large window.
5. ***Speedy Elevator Service***
   Three large, elegant high speed elevators, entered from a beautiful marble lobby give immediate, rapid service.
6. ***Ceilings 11 ft. High***
   High ceilings assure good circulation and healthful atmosphere.
7. ***Absolutely Sanitary***
   Entire building constructed of materials that will not accumulate dust or dirt. Large elaborate wash rooms and toilets.
8. ***Sound Proof***
   Massive, sound proof construction of this building makes it possible for tenants to enjoy all the advantages of being in a building all by themselves.
9. ***Ice Water***
   Continuous running Ice Water service throughout the entire building.
10. ***Center of Industrial Information***
    The Home of The Penton Publishing Company, where the entire nation comes for its authentic industrial information.

Here is your opportunity to move into conveniently located, delightfully comfortable quarters—at a surprisingly reasonable cost!

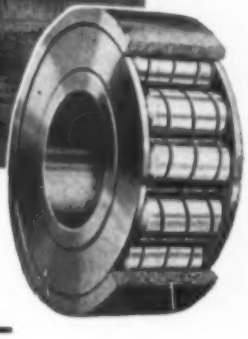
Make it a point to immediately inspect or investigate this building and see how favorable it would prove for your purposes.

Ask Us To Send You Complete Details

THE PENTON BUILDING CO.
Lakeside Avenue and West Third Street
CLEVELAND, OHIO.

108X

3-ton "Lo-Hed" hoist manufactured by The American Engineering Company, Philadelphia, Pa. Hoisting mechanism and trolley wheels equipped with Hyatt roller bearings. Operates with minimum headroom.



The Basis of Better Hoisting— The Right Bearings

IN hoisting equipment, quality of performance is determined largely by the bearings—upon them depends the ability of the working parts to operate effectively.

The American Engineering Company intrusts this responsibility to Hyatt roller bearings—they are standard in the operating mechanism and trolley wheels of the well known "Lo-Hed" Hoists.

Hyatt bearings are suited to the peculiar requirements of overhead handling equipment. They impart the easy turning and smooth operation necessary for quick spotting and accurate control. They have the strength to withstand the overloading and abuse to which such equipment is usually subjected. Their positive oil-conserving lubrication is a convenience, a safeguard and an economy.

Specify Hyatt bearings when buying equipment. They will serve you well and will prove a paying investment.

HYATT ROLLER BEARING COMPANY

NEWARK DETROIT CHICAGO SAN FRANCISCO
WORCESTER PHILADELPHIA PITTSBURGH
CLEVELAND MILWAUKEE

HYATT ROLLER BEARINGS FOR CRANES TROLLEYS AND HOISTS

What Users Say—

About Whiting Helical-Worm Ladle Gearing

"We consider that for ease and sureness of handling iron these ladles are the best obtainable. Have been adopted as standard at this works."—*A Pipe Foundry.*

"A large part of our success with the ladle we attribute to the fact that we are using the Whiting Corporation's Helical Geared Ladle which gearing is so easy in operation as to permit much more rapid pouring, an important factor in skulling of the spout."—*A Radiator Foundry.*

"The writer in his foundry experience, has never poured a ladle of this capacity (10,000 pounds) with such ease."—*A General Foundry.*

"The ladles in question are used daily for pouring approximately fifty tons of iron, and they have given us the very best of service."—*A Pipe Foundry.*

"The helical-worm gearing is giving perfect control and freedom from lost motion, and in our opinion is designed to stand up in service better than anything we have yet seen."—*A General Foundry.*

"The Helical-Worm Geared Ladle is fine in its operation in every way. It is so fine that we asked a few days ago for prices on changing over the other Ladles we have in stock."—*A Gas Engine Foundry.*

"This new type of ladle meets with our requirements very nicely, in fact our C plant reports the ladle to be the best for this purpose."—*A Pipe Foundry.*

"It is a faster and easier ladle to operate than those we have been using before."—*A General Foundry.*

"The tilting apparatus in particular is very smooth in operation, and permits of accurate control during pouring."—*A General Foundry.*

WHITING CORPORATION
(Formerly Whiting Foundry Equipment Co.)
15607 Lathrop Avenue, Harvey, Ill.
(Chicago Suburb)

WHITING
CRANES
FOUNDRY EQUIPMENT
RAILWAY SPECIALTIES

"We enclose our order No. — for two Whiting Tumblers. We have a quotation nearly $100.00 less for two Tumblers of similar specifications and size and made by people of excellent reputation. However, we are willing to pay this considerable premium for your Tumblers, because we know the excellent quality of your products."

SINGLE CLASS "A" MILL WITH PULLEY DRIVE

IMPORTANT ADVANTAGES

1. Removable trunnions, machined and bolted to head.
2. Gear bored, lugs turned, faces machined.
3. Welded gear guard, full depth of teeth.
4. Low standards, convenient for loading from either side.
5. Bolts fastening shell to head on outside of barrel.
6. Through bolts—no studs.
7. Machined surfaces between all castings.
8. Removable babbitted shell on line shaft bearing.
9. Door opening full length of barrel.
10. Wearing plates at door opening to protect barrel.
11. Improved clutch and brake for battery drive.

Send for Catalog No. 174

Whiting Corporation

15607 Lathrop Ave. (Chicago Suburb) Harvey, Ill.

WHITING CRANES FOUNDRY EQUIPMENT RAILWAY SPECIALTIES

"Where-To-Buy"

A classified-by-products list of advertisers for the convenience of readers. If you don't find what you want, write us and we will tell you where to get it. ¶ Index to advertisements will give you page number of any advertiser and by referring to advertisement you can get full particulars about products.

ABRASIVE (Sand Blast)
Harrison Supply Co.,
5-7 Dorchester St., Boston, Mass.

ABRASIVE WHEELS
Carborundum Co., Niagara Falls, N. Y.
Norton Co., Worcester, Mass.
Strand, N. A., & Co.,
5001-5009 North Lincoln St., Chicago, Ill.

ABRASIVES (Metallic)
Globe Steel Abrasive Co., Dept. F
Mansfield, O.
Steel Shot & Grit Co.,
61st & A. V. Ry., Pittsburgh, Pa.
Pangborn Corp.,
P. O. Box 851, Hagerstown, Md.

ACCOUNTANTS
Ernst & Ernst, 27 Cedar St., New York City.

ACCOUNTING SYSTEMS
Ernst & Ernst, 27 Cedar St., New York City.

ACETYLENE DISSOLVED OR IN CYLINDERS
International Oxygen Co., Newark, N. J.

ACETYLENE GENERATORS
Macleod Co
2225 Bogen St., Cincinnati, Ohio.
Oxweld Acetylene Co.,
646 Frelinghuysen Ave., Newark, N. J.

AIR COMPRESSORS
Curtis Pneumatic Machinery Co.,
1545 Kienlen Ave., St. Louis, Mo.
Ingersoll-Rand Co.,
11 Broadway, New York City.
New Haven Sand Blast Co., The,
6 Church St., New Haven, Conn.
Pennsylvania Pump & Compressor Co.,
Easton, Pa.
Sullivan Machinery Co.,
122 S. Michigan Ave., Chicago.
Westinghouse Traction Brake Co.,
Wilmerding, Pa.

AIR CONDITIONING SYSTEMS
Sturtevant, B. F., Co.,
Hyde Park, Boston, Mass.

AIR SEPARATORS—See SEPARATORS (Air—Moisture)

AIR TOOLS—SEE TOOLS (Pneumatic)

ALLOYS
American Boron Products Co., Inc.,
Reading, Pa.
Browne, deCourcy, Inc.,
120 Broadway, New York City.
Electro Metallurgical Sales Corp.,
30 E. 42nd St., New York City.
Metal & Thermit Corp.,
120 Broadway, New York City.
Titanium Alloy Mfg. Co.,
Niagara Falls, N. Y.

ALUMINUM
Rogers, Brown & Co.,
Room 1942, 30 Church St., New York City.

ALUMINUM (Alloys & Ingots)
British Aluminum Co., Ltd.,
165 Broadway, New York City.

ALUMINUM (Boronic)
American Boron Products Co., Inc.,
Reading, Pa.

ANNEALING OVENS—See OVENS (Annealing)

APPRAISERS (Valuation)
American Appraisal Co.,
165 Michigan Ave., Milwaukee, Wis.

APRONS (Leather Sand-Blast)
Pangborn Corporation,
P. O. Box 851, Hagerstown, Md.

ARC WELDING EQUIPMENT
Wilson Welder & Metals Co.,
Wilson Bldg., Hoboken Factory Terminal,
Hoboken, N. J.

ARCHITECTS (Industrial)
Beling-Bush Co., Inc.,
Drexel Building, Philadelphia, Pa.
Chase, Frank D., Inc.,
645 N. Michigan Ave., Chicago, Ill.

AUDITORS AND ACCOUNTANTS
Ernst & Ernst, 27 Cedar St., New York City.

BABBITT METAL
Ajax Metal Co.,
46 Richmond St., Philadelphia, Pa.

BANDS, SNAP FLASK (Steel)
Truscon Steel Co., Youngstown, Ohio.

BARROWS (Foundry)
Penn Foundry & Mfg. Co., Reading, Pa.
Sterling Wheelbarrow Co., Milwaukee, Wis.

BARS (Iron and Steel)
Bethlehem Steel Co., Bethlehem, Pa.
Truscon Steel Co., Youngstown, Ohio.

BEARINGS (Crane)
Hyatt Roller Bearing Co., Newark, N. J.

BEARINGS (Hoist)
Hyatt Roller Bearing Co., Newark, N. J.

BEARINGS (Roller)
Hyatt Roller Bearing Co., Newark, N. J.

BEARINGS (Steel Mill Equipment)
Hyatt Roller Bearing Co., Newark, N. J.

BEARINGS (Trolley)
Hyatt Roller Bearing Co., Newark, N. J.

BELLOWS (Molders)
Hill & Griffith Co., Cincinnati, Ohio.
Paxson, J. W., Co.,
Nicetown Lane and D St., Philadelphia, Pa.
Pettinos, George F.,
1206 Locust St., Philadelphia, Pa.

BINDERS—See CORE BINDERS

BLACKING MIXTURE
Dixon, Joseph, Crucible Co.,
Jersey City, N. J.
Pettinos, George F.,
1206 Locust St., Philadelphia, Pa.
Stevens, Frederic B., Inc.,
Third and Larned Sts., Detroit, Mich.

BLAST METERS
Bacharach Industrial Instrument Co.,
7000 Bennett St., Pittsburgh, Pa.
Clark, Chas. J., Blast Meter Co.,
Gladbrook, Iowa.

BLOW COCKS
Adams Co., The,
175 Foster St., Dubuque, Iowa.

BLOWERS
Ingersoll-Rand Co.,
11 Broadway, New York City.
Knickerbocker Co., The, Jackson, Mich.
Roots, P. H. & F. M., Co.,
Connersville, Ind.
Skinner Bros. Mfg. Co., Inc.,
1474 S. Vandeventer Ave., St. Louis, Mo.
Spencer Turbine Co., Hartford, Conn.
Sturtevant, B. F., Co.,
Hyde Park, Boston, Mass.

BLOWPIPES (Blazing, Cutting, Welding, Etc.)
Oxweld Acetylene Co.,
646 Frelinghuysen Ave., Newark, N. J.

BOLTS AND NUTS
Bethlehem Steel Co., Bethlehem, Pa.

BOOKS (Technical)
Penton Publishing Co., Cleveland, O.

BOTTOM PLATES (Steel)
Truscon Steel Co., Youngstown, Ohio.

BOXES (Tote)
Sterling Wheelbarrow Co., Milwaukee, Wis.
Truscon Steel Co., Youngstown, Ohio.

BRICK (Refractory)
Norton Co., Worcester, Mass.

BRICKS (Rubbing and Scouring)
Carborundum Co., Niagara Falls, N. Y.

BRONZE (Manganese)
Ajax Metal Co.,
46 Richmond St., Philadelphia, Pa.

BRUSHES
Paxson, J. W., Co.,
Nicetown Lane and D St., Philadelphia, Pa.

BRUSHES (Motor and Generator)
Dixon, Joseph, Crucible Co.,
Jersey City, N. J.
United States Graphite Co., Saginaw, Mich.

BRUSHES (Wire)
Paxson, J. W., Co.,
Nicetown Lane and D St., Philadelphia, Pa.
Specialty Mfg. Co.,
11400 Madison Ave., Cleveland, O.

BUCKETS (Clam Shell, Drag Line, Grab)
Brosius, Edgar E.,
223 Fourth St., Pittsburgh, Pa.
Industrial Works, Bay City, Mich.
Link-Belt Co.,
910 South Michigan Ave., Chicago, Ill.
Pawling & Harnischfeger Co.,
3805 National Ave., Milwaukee, Wis.
Williams, G. H., Co.,
611 Harbarger Lane, Erie, Pa.

BUCKETS (Elevating)
Bartlett, C. O., & Snow Co.,
French & Winter Sts., Cleveland, O.
Federal Malleable Co., West Allis, Wis.

BUCKETS (Foundry)
Penn Foundry & Mfg. Co., Reading, Pa.

BUCKET LOADERS FOR SAND MILLS
National Engineering Co.,
549 W. Washington Blvd., Chicago, Ill.

BUFFING COMPOSITIONS
Hill & Griffith Co., Cincinnati, Ohio.
Stevens, Frederic B., Inc.,
Third and Larned Sts., Detroit, Mich.

BUILDINGS (Factory and Foundry)
Chase, Frank D., Inc.,
645 N. Michigan Ave., Chicago, Ill.

BUILDINGS (Steel)
Scully-Jones & Co.,
2012 W. 13th St., Chicago, Ill.
Sly, W. W., Mfg. Co.,
4702 Train Ave., Cleveland, O.
Stevens, Frederic B., Inc.,
Third and Larned Sts., Detroit, Mich.
Swartwout Co.,
18511 Euclid Ave., Cleveland, O.
Truscon Steel Co., Youngstown, Ohio.
Whiting Corp., Harvey, Ill.
Young Brothers Co.,
6508 Mack Ave., Detroit, Mich.

BURNERS (Acetylene) See TORCHES AND BURNERS (Acetylene, Blow, Oxyacetylene)

BURNERS (Oil)
Foundry Equipment Co., The.,
1831 Columbus Rd., Cleveland, O.
Hauck Manufacturing Co.,
126 Tenth St., Brooklyn, N. Y.
Macleod Co.,
2225 Bogen St., Cincinnati, O.

Determining the value of over 25,000 properties

Accuracy in counting and in keeping account of property dollars is rapidly gaining its due recognition among American business men.

The clientele of The American Appraisal Company now includes more than 25,000 properties.

Every working day three and a half million property dollars are counted by means of American Appraisal service.

Supporting and guiding this intensive present experience with properties in every state of the union and abroad are twenty-eight years of exclusively appraisal work.

In those twenty-eight years American Appraisals have pioneered such important advances in valuation as the making of retrospective appraisals, and the development of standards for the measurement of depreciation.

For the use of business men interested in certain phases of depreciation and valuation we have recently published two booklets: "Property Records—Their Effect on Profit and Loss", and "When Insurance Insures and When It Doesn't".

We will be glad to send these postpaid to any business address.

THE AMERICAN APPRAISAL COMPANY—MILWAUKEE

Atlanta, Baltimore, Boston, Buffalo, Chicago, Cincinnati, Cleveland, Detroit, Indianapolis, Los Angeles, Milwaukee, Minneapolis, New Orleans, New York, Philadelphia, Pittsburgh, San Francisco, St. Louis, Seattle, Syracuse, Washington. The Canadian Appraisal Company, Limited, Montreal, Toronto

INVESTIGATIONS VALUATIONS, REPORTS — INDUSTRIALS, PUBLIC UTILITIES, NATURAL RESOURCES

An American Appraisal

THE AUTHORITY

©The A. A. Co., 1924

BURRS (For Pattern-Makers)
Hergi Mfg. Co.,
250 Fifth St., Bridgeport, Conn.

BUSINESS CARDS (Engraved)
Wiggins, J. B., Co.,
1104 S. Wabash Ave., Chicago, Ill.

BUSINESS METHODS
Ernst & Ernst, 27 Cedar St., New York City.

CARBON BURNING APPARATUS
Oxweld Acetylene Co.,
646 Frelinghuysen Ave., Newark, N. J.

CARS (Annealing, Billet, Furnace, Charging Core Oven Pig Iron)
Chase Foundry & Mfg. Co., The,
Columbus, O.
Foundry Equipment Co., The,
1831 Columbus Rd., Cleveland, O.
Penn Foundry & Mfg. Co., Reading, Pa.
Scully-Jones & Co.,
2012 W. 13th St., Chicago, Ill.
Whiting Corporation, Harvey, Ill.

CARS (Platform, Industrial Railway, Transfer, Narrow Gage)
Foundry Equipment Co., The,
1831 Columbus Rd., Cleveland, O.
Penn Foundry & Mfg. Co., Reading, Pa.

CARS (Sand Blast)
Pangborn Corporation,
P. O. Box 851, Hagerstown, Md.

CASE HARDENING COMPOUND
Pettinos, George F.,
1206 Locust St., Philadelphia, Pa.

CASTINGS (Gray Iron)
Bethlehem Steel Co., Bethlehem, Pa.

CASTINGS (Malleable)
Federal Malleable Co., West Allis, Wis.

CEMENT (Furnace)
Dixon, Joseph, Crucible Co.,
Jersey City, N. J.

CEMENT (Iron, Steel, Brass)
Paxson, J. W., Co.,
Nicetown Lane and D St., Philadelphia, Pa.
Stevens, Frederic B., Inc.,
Third and Larned Sts., Detroit, Mich.

CEMENT (Refractory)
Norton Co., Worcester, Mass.

CHAIN BELTING
Federal Malleable Co., West Allis, Wis.
Link-Belt Co.,
910 South Michigan Ave., Chicago, Ill.

CHAIN DRIVES (Silent)
Link-Belt Co.,
910 South Michigan Ave., Chicago, Ill.

CHAPLETS
Paxson, J. W., Co.,
Nicetown Lane and D St., Philadelphia, Pa.
Pettinos, George F.,
1206 Locust St., Philadelphia, Pa.
Philadelphia Chaplet & Mfg. Co.,
Philadelphia, Pa.
U. S. Chaplet & Supply Co.,
140 Cedar St., New York City.

CHARGING EQUIPMENT (Air Furnace)
American Foundry Equipment Co., The,
368 Madison Ave., New York City.

CHEMISTS
Kawin, Chas. C., Co.,
431 South Dearborn St., Chicago, Ill.

CHIPPERS (Pneumatic) — See HAMMERS (Chipping and Riveting, Pneumatic)

CHISEL BLANKS
Cleveland Steel Tool Co.,
660 E. 82nd St., Cleveland, O.

CINDER MILLS
American Foundry Equipment Co.,
368 Madison Ave., New York City.
Cleveland Nickel Works,
1147 W. 67th St., Cleveland, O.
Sly, W. W., Mfg. Co.,
4702 Train Ave., Cleveland, O.
Standard Equipment Co.,
185 Church St., New Haven, Conn.
Standard Radial Blast Corp.,
519-30 Church St., New York City.
Whiting Corp., Harvey, Ill.

CLAMPS (Hose)—See HOSE CLAMPS

CLAMPS (Malleable Iron)
Malleable Iron Fittings Co., Branford, Conn.

CLAY (Fire)
Keener Sand & Clay Co.,
514 Hartman Bldg., Columbus, O.

CLOTH (Abrasive)
Carborundum Co., Niagara Falls, N. Y.

COAL
Hillman Coal & Coke Co.,
First Nat'l Bank Bldg., Pittsburgh, Pa.

COAL (Bituminous)
Bethlehem Steel Co., Bethlehem, Pa.

COAL (Smithing)
Rogers, Brown & Co.,
433 Vine St., Cincinnati, O.

COAL CRUSHERS AND PULVERIZERS
Bartlett, C. O., & Snow Co.,
French and Winter Sts., Cleveland, O.
Grindle Fuel Equipment Co., Harvey, Ill.

COAL HANDLING MACHINERY
Bartlett, C. O., & Snow Co.,
French & Winter Sts., Cleveland, O.
Link-Belt Co.,
910 South Michigan Ave., Chicago,

COAL, ORE AND ASH HANDLING MACHINERY
Bartlett, C. O., & Snow Co.,
French and Winter Sts., Cleveland, O.

COKE
Bethlehem Steel Co., Bethlehem, Pa.
Hanna, M. A., Co., The,
Leader-News Bldg., Cleveland, O.
Hillman Coal & Coke Co.,
First Nat'l Bank Bldg., Pittsburgh, Pa.
Rogers, Brown & Co.,
433 Vine St., Cincinnati, O.
Stevens, Frederic B., Inc.,
Third and Larned Sts., Detroit, Mich.

COLLECTING AND CONVEYING SYSTEMS (Pneumatic)
Sturtevant, B. F., Co.,
Hyde Park, Boston, Mass.

COMPRESSORS (Air) — See AIR COMPRESSORS

CONCRETE REINFORCEMENTS
Truscon Steel Co., Youngstown, O.

CONDENSERS (Surface and Low Level Jet)
Ingersoll-Rand Co.,
11 Broadway, New York City.

CONSTRUCTION (Foundry Buildings)
Beling-Bush Co., Inc.,
Drexel Building, Philadelphia, Pa.
Chase, Frank D., Inc.,
645 N. Michigan Ave., Chicago, Ill.

CONSULTANTS (Auditing & Accounting)
Ernst & Ernst, 27 Cedar St., New York City.

CONTRACTORS—See ENGINEERS AND CONTRACTORS

CONVERTERS (Steel)
Whiting Corporation, Harvey, Ill.

CONVEYING & ELEVATING EQUIPMENT
Bartlett, C. O., & Snow Co.,
French & Winter Sts., Cleveland, O.
Link-Belt Co.,
910 South Michigan Ave., Chicago, Ill.

CONVEYING EQUIPMENT (Overhead For Factories)
Bartlett, C. O., & Snow Co.,
French and Winter Sts., Cleveland, O.
Cleveland Crane & Engineering Co.,
Wickliffe, O.

CONVEYING SYSTEMS
Arcade Mfg. Co., Dept. D, Freeport, Ill.
Bartlett, C. O., & Snow Co.,
French and Winter Sts., Cleveland, O.

CONVEYORS (Ash, Coal)
Bartlett, C. O., & Snow Co.,
French and Winter Sts., Cleveland, O.
Roots, P. H. & F. M., Co.,
Connersville, Ind.

CONVEYORS (Belt, Bucket and Chain)
Bartlett, C. O., & Snow Co.,
French and Winter Sts., Cleveland, O
Link-Belt Co.,
910 South Michigan Ave., Chicago, Ill.

COPPER (Boronic)
American Boron Products Co., Inc.,
Reading, Pa.

CORE BENCHES
Malleable Iron Fittings Co., Branford, Conn.

CORE BINDERS
Borne Scrymser Co.,
17 Battery Place, New York City.
Corn Products Refining Co.,
17 Battery Place, New York City.
Hill & Griffith Co., Cincinnati, Ohio.
Kellogg, Spencer, & Sons, Inc., Buffalo, N. Y.
Knefler-Bates Mfg. Co., Indianapolis, Ind.
Mifflin Chemical Corp.,
Delaware Ave. and Tasker St.,
Philadelphia, Pa.
Paxson, J. W., Co.,
Nicetown Lane and D St., Philadelphia, Pa.
Smith, Werner G.,
2191 W. 110th St., Cleveland, O.
Stevens, Frederic B., Inc.,
Third and Larned Sts., Detroit, Mich.

CORE BOXES (Steel and Wood)
Truscon Steel Co., Youngstown, Ohio.

CORE BREAKERS
Sullivan Machinery Co.,
122 S. Michigan Ave., Chicago, Ill.

CORE COMPOUND
Corn Products Refining Co.,
17 Battery Place, New York City.
Hill & Griffith Co., Cincinnati, Ohio.
Kellogg, Spencer, & Sons, Inc., Buffalo, N. Y.
Paxson, J. W., Co.,
Nicetown Lane and D St., Philadelphia, Pa.
Pettinos, George F.,
1206 Locust St., Philadelphia, Pa.
Smith, Werner G.,
2191 W. 110th St., Cleveland, O.
Stevens, Frederic B., Inc.,
Third and Larned Sts., Detroit, Mich.

CORE DRYING TRAYS
Truscon Steel Co., Youngstown, O.

CORE FLOUR
Paxson, J. W., Co.,
Nicetown Lane and D Sts., Philadelphia, Pa.
Stevens, Frederic B., Inc.,
Third and Larned Sts., Detroit, Mich

CORE MAKING MACHINES
American Foundry Equipment Co., The,
368 Madison Ave., New York City.
Arcade Mfg. Co., Dept. D, Freeport, Ill.
Herman Pneumatic Machine Co.,
Union Bank Bldg., Pittsburgh, Pa.

CORE OILS
Borne Scrymser Co.,
17 Battery Place, New York City.
Kellogg, Spencer, & Sons, Inc., Buffalo, N. Y.
Mifflin Chemical Corp.,
Delaware Ave. and Tasker St.,
Philadelphia, Pa.
Paxson, J. W., Co.,
Nicetown Lane and D St., Philadelphia, Pa.
Smith, Werner G.,
2191 W. 110th St., Cleveland, O.
Stevens, Frederic B., Inc.,
Third and Larned Sts., Detroit, Mich.

CORE OVENS
Foundry Equipment Co., The,
1831 Columbus Rd., Cleveland, O.
Holcroft & Co.,
5545 Epworth Blvd., Detroit, Mich.
Paxson, J. W., Co.,
Nicetown Lane and D St., Philadelphia, Pa.
Swartwout Co.,
18511 Euclid Ave., Cleveland, O.

CORE OVEN CAR PULLER
Whiting Corp., Harvey, Ill.

CORE PLATES (Steel)
Truscon Steel Co., Youngstown, O.

CORE RACKS
Foundry Equipment Co., The,
1831 Columbus Rd., Cleveland, O.
Holcroft & Co.,
6545 Epworth Blvd., Detroit, Mich.
Sly, W. W., Mfg. Co., The,
4702 Train Ave., Cleveland, O.
Truscon Steel Co., Youngstown, O.
Whiting Corp., Harvey, Ill.

CORE REDUCERS
National Engineering Co.,
549 W. Washington Blvd., Chicago, Ill.

CORE RODS (Steel)
Truscon Steel Co., Youngstown, O.

CORE ROOM EQUIPMENT
Truscon Steel Co., Youngstown, O.

CORE SAND MIXERS
American Foundry Equipment Co., The,
368 Madison Ave., New York City.
National Engineering Co.,
549 W. Washington Blvd., Chicago, Ill.
Standard Sand & Machine Co., The,
5151 St. Clair Ave., Cleveland, O.

CORE TRAYS (Steel)
Truscon Steel Co., Youngstown, O.

CORE WASH
Hill & Griffith Co., Cincinnati, Ohio.
Paxson, J. W., Co.,
Nicetown Lane and D St., Philadelphia, Pa.
Pettinos, George F.,
1206 Locust St., Philadelphia, Pa.
Stevens, Frederic B., Inc.,
Third and Larned Sts., Detroit, Mich.
United States Graphite Co., Saginaw, Mich.

COST SYSTEMS
Ernst & Ernst, 27 Cedar St., York City.

Audit the Past and Budget the Future

Business today, with all its human factors, is an exact science. The dividends of success are earned by managers whose operations are based upon dependable *facts* and figures.

The success of tomorrow is *planned* today. It is built upon the success of today, which the plans of yesterday made possible.

The Detailed Audit provides the exact knowledge modern management requires. It is *complete* in its presentation of the facts behind the figures. It is free from the qualified statements of the balance sheet audit. It is the *whole truth*—the necessary and *only* basis for the Budget.

The Business Budget protects profits, by preventing loss. It safeguards against over-expansion, over-production, over-expenditure. It shows the volume of expected sales, the consequent production schedules and inventory requirements. It is the business *plan*—a *guide*, not a law—based upon judgment, past experience, figures and facts.

Progressive management *knows that it must know*, and budgets the future. Elimination of ignorance and guess-work is as necessary to business as profit itself—for the SAVING MADE thereby *IS* profit—just as the difference between cost and selling price is profit.

ERNST & ERNST

AUDITS—SYSTEMS—TAX SERVICE

NEW YORK	BALTIMORE	DETROIT	PITTSBURGH	MILWAUKEE	KANSAS CITY	NEW ORLEANS
BUFFALO	RICHMOND	YOUNGSTOWN	GRAND RAPIDS	MINNEAPOLIS	OMAHA	DALLAS
ROCHESTER	CLEVELAND	AKRON	KALAMAZOO	ST. PAUL	DENVER	HOUSTON
BOSTON	CINCINNATI	CANTON	WHEELING	DAVENPORT	ATLANTA	FORT WORTH
PROVIDENCE	TOLEDO	DAYTON	ERIE	INDIANAPOLIS	SAN FRANCISCO	SAN ANTONIO
PHILADELPHIA	COLUMBUS	LOUISVILLE	MEMPHIS	ST. LOUIS	LOS ANGELES	WACO
			CHICAGO			

TAX OFFICE: 910 TO 918 MUNSEY BLDG., WASHINGTON, D. C.

Skinner Bros.

Baetz Patent HEATING SYSTEM

Heating Equipment Builded That Heats Your Foundry Thoroughly

Uniform temperature, every hour of the day, on every floor, in every corner, all open spaces heated, none can escape no matter how cold it may be outside the foundry when Skinner Heaters are used. There is the satisfaction in having heating equipment that is builded for your requirements. Under such favorable conditions foundry men can do their best and biggest work and production is kept up, without stress, to its full capacity.

Performs with economy in every hour of operation

Skinner Heaters are individual compact units, constructed in the floor type and the inverted type for overhead suspension. They are effective because of their scientific, simple, construction. No outside pipes or ducts are used for air distribution. Fan operated by any power available. Use live or exhaust steam at high or low pressure. They are portable and can be moved from one place to another. Completely assembled before shipment. Easy to install, most economical to operate and the maintenance cost is exceptionally low. Performance is guaranteed when installed as directed by our engineers.

Among the Prominent Users of Skinner Heaters are:

American Car & Foundry, Federal Foundry, Best Foundry Co., Elliott Frog & Switch Co., Black Clawson Co., Massillon Steel Casting Co., Long & Allstatter Co., Westinghouse Electric & Mfg. Co., American Stove Co., International Shoe Co., General Electric Co., Ford Motor Co., Maxwell Motors Corp., National Enameling & Stamping Works, Standard Steel Car Co., Commonwealth Steel Co., American Brake Co.

Skinner Bros Baetz Patent Heater Steam Coil Type S. C. uses live or exhaust steam at any pressure. Where steam is not available we furnish Skinner Bros Direct-Fired Type D. F. which burns coal, coke, wood, gas or oil.

Guaranteed to keep every part of the foundry at a comfortable working temperature, at all times, regardless of weather conditions.

Skinner Bros Manufacturing Co., Inc.

More Than 30 Years—The Pioneers—Giving Satisfaction

Sole and exclusive manufacturers of Skinner Bros Baetz Patent Heaters and Skinner Bros Patented Direct Fired Heaters

Home Office and Factories, 1422 S. Vandeventer Ave., St. Louis, Mo.

Eastern Office and Factories, 142 Bayway, Elizabeth, N. J.

Sales Offices and Branches in all Principal Cities

COUPLINGS (Flexible)
Roots, P. H. & F. M., Co., Connersville, Ind.

CRANES (Bucket)
Link-Belt Co., 910 South Michigan Ave., Chicago, Ill.
Milwaukee Electric Crane & Mfg. Co., Inc., Milwaukee, Wis.
Pawling & Harnischfeger Co., 3805 National Ave., Milwaukee, Wis.
Whiting Corp., Harvey, Ill.

CRANES (Charging)
Cleveland Crane & Engineering Co., Wickliffe, Ohio.

CRANES (Crawling Tractor)
Industrial Works, Bay City, Mich.

CRANES (Electric Traveling)
Chesapeake Iron Works, Baltimore, Md.
Cleveland Crane & Engineering Co., Wickliffe, Ohio.
Link Belt Co., 910 South Michigan Ave., Chicago, Ill.
Milwaukee Electric Crane & Mfg. Co., Milwaukee, Wis.
Northern Engineering Works, 2605 Atwater Bldg., Detroit, Mich.
Pawling & Harnischfeger Co., 3805 National Ave., Milwaukee, Wis.
Scully-Jones & Co., 2012 W. 13th St., Chicago, Ill.
Whiting Corp., Harvey, Ill.

CRANES (Erection)
Industrial Works, Bay City, Mich.

CRANES (Hand Traveling)
Armington Engineering Co., The, Euclid, O.
Chesapeake Iron Works, Baltimore, Md.
Cleveland Crane & Engineering Co., Wickliffe, Ohio.
Northern Engineering Works, 2605 Atwater Bldg., Detroit, Mich.
Pawling & Harnischfeger Co., 3805 National Ave., Milwaukee, Wis.
Scully-Jones & Co., 2012 W. 13th St., Chicago, Ill.
Whiting Corp., Harvey, Ill.

CRANES (Hydraulic)
Cleveland Crane & Engineering Co., Wickliffe, Ohio.

CRANES (Jib)
Armington Engineering Co., The, Euclid, O.
Pawling & Harnischfeger Co., 3805 National Ave., Milwaukee, Wis.
Scully-Jones & Co., 2012 W. 13th St., Chicago, Ill.
Whiting Corp., Harvey, Ill.

CRANES (Locomotive)
Industrial Works, Bay City, Mich.
Link-Belt Co., 910 South Michigan Ave., Chicago, Ill.

CRANES (Steam & Pneumatic Wire Mills)
Cleveland Crane & Engineering Co., Wickliffe, Ohio.

CRANES (Wall)
Milwaukee Electric Crane & Mfg. Co., Milwaukee, Wis.
Pawling & Harnischfeger Co., 3805 National Ave., Milwaukee, Wis.
Whiting Corp., Harvey, Ill.

CRUCIBLES
Dixon, Jos., Crucible Co., Jersey City, N. J.
Gautier, J. H., & Co., Greene St., Jersey City, N. J.
Lava Crucible Co. of Pittsburgh, Wabash Bldg., Pittsburgh, Pa.
Ross-Tacony Crucible Co., Tacony, Philadelphia, Pa.

CRUCIBLE LIFTERS
Foundry Equipment Co., 1831 Columbus Rd., Cleveland, O.

CRUSHED STEEL—See STEEL (Crushed)

CUPOLA BLOWERS
Spencer Turbine Co., Hartford, Conn.

CUPOLA BRICK
Paxson, J. W., Co., Nicetown Lane and D St., Philadelphia, Pa.
Stevens, Frederic B., Inc., Third and Larned Sts., Detroit, Mich.
Whiting Corp., Harvey, Ill.

CUPOLA CHARGING MACHINES
Whiting Corp., Harvey, Ill.

CUPOLA DAUB
Stevens, Frederic B., Inc., Third and Larned Sts., Detroit, Mich.

CUPOLA LIGHTERS
Hauck Mfg. Co., 126 Tenth St., Brooklyn, N. Y.
Macleod Co., 2225 Bogen St., Cincinnati, O.

CUPOLAS
Northern Engineering Works, 2605 Atwater Bldg., Detroit, Mich.
Paxson, J. W., Co., Nicetown Lane and D st., Philadelphia, Pa.
Sly, W. W. Mfg. Co., The, 4702 Train Ave., Cleveland, O.
Whiting Corp., Harvey, Ill.

CUTTING AND WELDING EQUIPMENT (Electric Arc)—See WELDING AND CUTTING EQUIPMENT (Electric Arc)

CUTTING AND WELDING (Oxy-Acetylene)—See WELDING AND CUTTING APPARATUS AND SUPPLIES (Oxy-Acetylene Process)

CYLINDERS (Acetylene)—See ACETYLENE IN CYLINDERS

CYLINDERS (Oxygen)—See OXYGEN IN CYLINDERS

DECARBONIZING APPARATUS
Oxweld Acetylene Co., 646 Frelinghuysen Ave., Newark, N. J.

DEHUMIDIFYING APPARATUS
Sturtevant, B. F., Co., Hyde Park, Boston, Mass.

DEOXIDIZERS
Titanium Alloy Mfg. Co., The, Niagara Falls, N. Y

DIE CASTING EQUIPMENT
Rohmer, Gabriel E., 516 5th Ave., New York City.

DISCS (Grinding)
Carborundum Co., Niagara Falls, N. Y.

DOWELS
Paxson, J. W., Co., Nicetown Lane and D St., Philadelphia, Pa.
Truscon Steel Co., Youngstown, O.

DRILL PRESSES
Royersford Foundry & Machine Co., Royersford, Pa.

DRILLS (Pneumatic)
Ingersoll-Rand Co., 11 Broadway, New York City.

DRYERS (Sand, Coal, Ores, Chemicals, etc)
Bartlett, C. O., & Snow Co., French and Winter Sts., Cleveland, O.

DUST ARRESTING SYSTEMS
American Foundry Equipment Co., The, 368 Madison Ave., New York City.
Knickerbocker Co., The, Jackson, Mich.
Koven, L. O., & Brother, Inc., 154 Ogden Ave., Jersey City, N. J.
Macleod Co., 2225 Bogen St., Cincinnati, O.
Pangborn Corporation, P. O. Box 851, Hagerstown, Md.
Paxson, J. W., Co., Nicetown Lane and D St., Philadelphia, Pa.
Skinner Bros. Mfg. Co., Inc., 1474 S. Vandeventer Ave., St. Louis, Mo.
Sly, W. W., Mfg. Co., 4702 Train Ave., Cleveland, O.
Sturtevant, B. F., Co., Hyde Park, Boston, Mass.
Whiting Corp., Harvey, Ill.

DUST ARRESTORS
Cleveland Nickel Works, 1147 W. 67th St., Cleveland, O.
New Haven Sand Blast Co., The, 6 Church St., New Haven, Conn.

ELECTRIC ARC EQUIPMENT FOR CUTTING AND WELDING—See WELDING AND CUTTING EQUIPMENT (Electric Arc)

ELEVATORS
Link-Belt Co., 910 South Michigan Ave., Chicago, Ill.
Whiting Corporation, Harvey, Ill.

ELEVATORS (Bucket)
Bartlett, C. O., & Snow Co., French and Winter Sts., Cleveland, O.

ENGINEERS AND CONTRACTORS
Beling-Bush Co., Inc., Drexel Building, Philadelphia, Pa.
Chase, Frank D., Inc., 645 N. Michigan Ave., Chicago, Ill.

ENGINEERS (Consulting)
Chase, Frank D., Inc., 645 N. Michigan Ave., Chicago, Ill.
Ernst & Ernst, 27 Cedar St., New York City.

ENGINEERS (Foundry, Mechanical, Electrical, etc.)
Chase, Frank D., Inc., 645 N. Michigan Ave., Chicago, Ill.
Kawin, Charles C., Co., 431 South Dearborn St., Chicago, Ill.
Pangborn Corporation, P. O. Box 851, Hagerstown, Md.
Paxson, J. W. Co., Nicetown Lane and D St., Philadelphia, Pa.
Standard Sand & Machine Co., 5151 St. Clair Ave., Cleveland, O.

ENGINES (Oil, Gas, Steam)
Ingersoll-Rand Co., 11 Broadway, New York City.

ENGRAVERS (Steel and Copper Plate)
Wiggins, J. B., Co., 1104 S. Wabash Ave., Chicago, Ill.

EXHAUST SYSTEMS
American Foundry Equipment Co., The, 368 Madison Ave., New York City.
Koven, L. O., & Brother, Inc., 154 Ogden Ave., Jersey City, N. J.
Pangborn Corporation, P. O. Box 851, Hagerstown, Md.
Paxson, J. W., Co., Nicetown Lane and D St., Philadelphia, Pa.
Skinner Bros. Mfg. Co., Inc., 1474 S. Vandeventer Ave., St. Louis, Mo.
Sly, W. W., Mfg. Co., 4702 Train Ave., Cleveland, O.
Sturtevant, B. F., Co., Hyde Park, Boston, Mass.

EXHAUSTERS (Gas)
Roots, P. H. & F. M., Co., Connersville, Ind.
Sturtevant, B. F., Co., Hyde Park, Boston, Mass.

EYE PROTECTORS—See GOGGLES AND EYE PROTECTORS

FACINGS
Dixon, Jos., Crucible Co., Jersey City, N. J.
Hill & Griffth Co., Cincinnati, Ohio.
Knefler-Bates Mfg. Co., Indianapolis, Ind.
Paxson, J. W., Co., Nicetown Lane and D St., Philadelphia, Pa.
Pettinos, George F., 1206 Locust St., Philadelphia, Pa.
Stevens, Frederic B., Inc., Third and Larned Sts., Detroit, Mich
United States Graphite Co., Saginaw, Mich.

FACING SAND MIXERS
National Engineering Co., 549 W. Washington Blvd., Chicago, Ill
Standard Sand & Machine Co., The, 5151 St. Clair Ave., Cleveland, O

FACTORY AND FOUNDRY BUILDINGS
Beling-Bush Co., Inc., Drexel Building, Philadelphia, Pa.
Chase, Frank D., Inc., 645 N. Michigan Ave., Chicago, Ill.

FACTORY MANAGEMENT SYSTEMS
Ernst & Ernst, 27 Cedar St., New York City.

FANS
Skinner Bros. Mfg. Co., Inc., 1474 S. Vandeventer Ave., St. Louis, Mo.
Sturtevant, B. F., Co., Hyde Park, Boston, Mass.

FERROALLOYS
Browne, deCourcy, Inc., 120 Broadway, New York City.
Electro Metallurgical Sales Corp., 30 E. 42nd St., New York City.

FERRO CARBON-TITANIUM
Titanium Alloy Mfg. Co., Niagara Falls, N. Y.

FERROCHROME
Electro Metallurgical Sales Corp., 30 E. 42nd St., New York City.

FERROMANGANESE
Bethlehem Steel Co., Bethlehem, Pa.
Electro Metallurgical Sales Corp., 30 E. 42nd St., New York City.
Foundry Manganese Co., 208 Harrison Bldg., Philadelphia, Pa.
Leavitt, C. W., & Co., 30 Church St., New York City.

FERROSILICON
Electro Metallurgical Sales Corp., 30 E. 42nd St., New York City.
Foundry Manganese Co., 208 Harrison Bldg., Philadelphia, Pa.

FILLET (Leather, Wood and Paper)
Paxson, J. W., Co., Nicetown Lane and D St., Philadelphia, Pa.

CHESAPEAKE CRANES

RUGGED ENDURING

ESPECIALLY ADAPTED FOR FOUNDRY SERVICE

CHESAPEAKE IRON WORKS
Baltimore Maryland

Controlled With One Hand

The special pendant controller of the Motorbloc, is operated by the fingers of one hand, leaving the other free to guide the load. This is only one of the many features of this motor driven chain hoist.

Write for Bulletin S-102.

MOTORBLOC CORPORATION
Summerdale, Philadelphia, Pa.

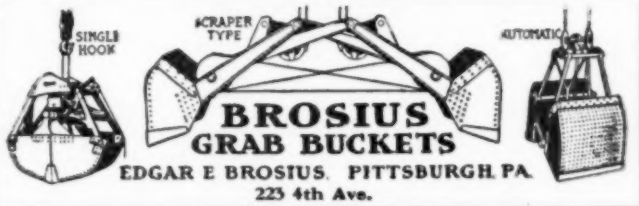
NORTHERN CRANES

All types—all capacities
also
all forms of electric and air hoists.
Ask for our latest bulletins
Northern Engineering Works
2605 Atwater St., Detroit, Mich.

HANNA AIR HOISTS

Price is a small fraction of any other type of Power Hoist

HANNA ENGINEERING WORKS
1759 ELSTON AVE., CHICAGO, ILL.



BROSIUS GRAB BUCKETS

EDGAR E BROSIUS PITTSBURGH PA.
223 4th Ave.

LO-HED

"The Electric Hoist that operates in the Minimum Headroom"

Affords precise control!

The "Lo-Hed" handles foundry loads, from cores to heavy molds, with accurate and sensitive control.

It lowers cope to cover drag, for instance, without the slightest jar.

Sensitive control is only one of many important features that make the "Lo-Hed" the ideal hoist for foundries.

And because the "Lo-Hed" operates in the absolute minimum headroom it can be used anywhere in any foundry regardless of low ceilings or congested floors!

Get the details—Write for the "Lo-Hed" Catalog—Today!

"Lo-Hed" hoist lowering cope to cover drag.

American Engineering Company
Thompson and Cumberland Sts., Philadelphia

THE MILWAUKEE CRANE

Milwaukee Monorail Hoist

is noted for its easy, positive control. It is a complete crane unit—self contained, self oiling.

May we send you full details of our Hoisting and Transfer Equipment?

MILWAUKEE
ELECTRIC CRANE & MFG. CO. INC.
MILWAUKEE-WIS-U.S.A.

Direct Factory Representatives: Detroit, Los Angeles, San Francisco, Denver, St. Louis, New York, Chicago, Pittsburgh, Portland, Ore., Birmingham, Houston.

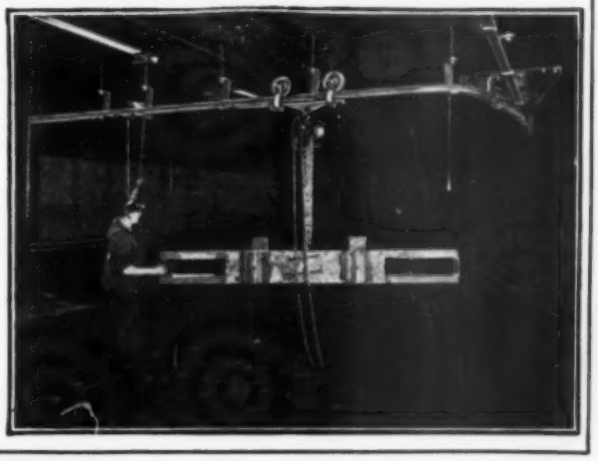
ARMINGTON
TEE RAIL CARRIER

ARMINGTON
Traveling Cranes
Jib Cranes
Wall Cranes
I Beam Trolleys
Hand Hoists

Using the overhead space to carry materials, is one big step in cost cutting. Carrying them rapidly with a minimum effort to the operator is another.

If you are not already familiar with the Tee Rail Carrier, you can not afford to delay further to investigate this labor saver.

It can be applied to your building.



THE ARMINGTON ENGINEERING CO., EUCLID, O.

FIRE BRICK AND CLAY
Carborundum Co., Niagara Falls, N. Y.
Gautier, J. H., & Co.,
Greene St., Jersey City, N. J.
Stevens, Frederic B., Inc.,
Third and Larned Sts., Detroit, Mich.

FIRE SAND
Carborundum Co., Niagara Falls, N. Y.
Pettinos, George F.,
1206 Locust St., Philadelphia, Pa.

FLASKS
Adams Co., The,
175 Foster St., Dubuque, Iowa.
American Foundry Equipment Co., The,
368 Madison Ave., New York City.
Arcade Mfg. Co., Dept. D, Freeport, Ill.
Hill & Griffith Co., Cincinnati, Ohio.
Paxson, J. W., Co.,
Nicetown Lane and D St., Philadelphia, Pa.
Sterling Wheelbarrow Co., Milwaukee, Wis.
Truscon Steel Co., Youngstown, Ohio.

FLASK FITTINGS
Truscon Steel Co., Youngstown, Ohio.

FLOUR (Foundry)
Knefler-Bates Mfg. Co., Indianapolis, Ind.
Paxson, J. W., Co.,
Nicetown Lane and D St., Philadelphia, Pa.

FLUOR SPAR
Hillside Fluor Spar Mines,
First National Bank Bldg., Chicago, Ill.

FLUX (Iron, Brass, Steel, Copper or Aluminum)
Chemical Treatment Co.,
81 New St., New York City.
Hillside Fluor Spar Mines,
First National Bank Bldg., Chicago, Ill.
Paxson, J. W., Co.,
Nicetown Lane and D St., Philadelphia, Pa.

FLUX (Welding)
Chemical Treatment Co.,
81 New St., New York City.
Oxweld Acetylene Co.,
646 Frelinghuysen Ave., Newark, N. J.

FORGINGS (Pressed and Drop)
Bethlehem Steel Co., Bethlehem, Pa.

FOUNDRY ADVISORS
Kawin, Charles C., Co.,
431 South Dearborn St., Chicago, Ill.

FOUNDRY ENGINEERS—See ENGINEERS (Foundry, Mechanical, Electrical, etc.)

FOUNDRY EQUIPMENT
Adams Co., The,
175 Foster St., Dubuque, Iowa.
American Foundry Equipment Co., The,
368 Madison Ave., New York City.
Arcade Mfg. Co., Dept. D, Freeport, Ill.
Chemical Treatment Co.,
81 New St., New York City.
Foundry Equipment Co.,
1831 Columbus Road, Cleveland, O.
Henderson Bros. Co.,
135 South Leonard St., Waterbury, Conn.
National Engineering Co.,
549 W. Washington Blvd., Chicago, Ill.
Pangborn Corp.,
P. O. Box 851, Hagerstown, Md.
Paxson, J. W., Co.,
Nicetown Lane and D St., Philadelphia, Pa.
Penn Foundry & Mfg. Co., Reading, Pa.
Sly, W. W., Mfg. Co.,
4702 Train Ave., Cleveland, O.
Standard Sand & Machine Co.,
5151 St. Clair Ave., Cleveland, O.
Stevens, Frederic B., Inc.,
Third and Larned Sts., Detroit, Mich.
Truscon Steel Co., Youngstown, Ohio.
Whiting Corp., Harvey, Ill.

FOUNDRY EQUIPMENT (Second Hand)
Clifton-Pratt Co., The, Cincinnati, O.
Crawford, F. H.,
305 Broadway, New York City.
Scully-Jones & Co.,
2012 W. 113th St., Chicago, Ill.

FOUNDRY GLOVES—See GLOVES (Foundry)

FOUNDRY SPECIALISTS
Sly, W. W., Mfg. Co.,
4702 Train Ave., Cleveland, O.
Whiting Corp., Harvey, Ill.

FOUNDRY SUPPLIES
Champion Foundry & Machine Co.,
2419 W. 14th St., Chicago, Ill.
Chemical Treatment Co.,
81 New St., New York City.
Hill & Griffith Co., Cincinnati, Ohio.
National Engineering Co.,
549 W. Washington Blvd., Chicago, Ill.
Pangborn Corporation,
P. O. Box 851, Hagerstown, Md.
Paxson, J. W., Co.,
Nicetown Lane and D St., Philadelphia, Pa.
Pettinos, George F.,
1206 Locust St., Philadelphia, Pa.
Stevens, Frederic B., Inc.,
Third and Larned Sts., Detroit, Mich.

FURNACE LININGS
Carborundum Co., Niagara Falls, N. Y.

FURNACE LININGS (Graphite)
Dixon, Jos., Crucible Co., Jersey City, N. J.

FURNACES (Annealing & Case Hardening)
Electric Furnace Co., Salem, O.
Whiting Corporation, Harvey, Ill.

FURNACES (Brass & Aluminum)
Electric Furnace Co., Salem, O.
Foundry Equipment Co.,
1831 Columbus Road, Cleveland, O.
Paxson, J. W., Co.,
Nicetown Lane and D St., Philadelphia, Pa.
Pittsburgh Electric Furnace Corp.,
Union Bank Bldg., Pitstburgh, Pa.
Stevens, Frederic B., Inc.,
Third and Larned Sts., Detroit, Mich.
Whiting Corporation, Harvey, Ill.

FURNACES (Core Oven)
Swindell, Wm., & Bros.,
P. O. Box 1753, Pittsburgh, Pa.

FURNACES (Crucible Steel)
Foundry Equipment Co.,
1831 Columbus Road, Cleveland, O.

FURNACES (Electric-Brass & Aluminum)
Ajax Metal Co.,
46 Richmond St., Philadelphia, Pa.
Detroit Electric Furnace Co.,
2331 First National Bank Bldg.,
Detroit, Mich.
Electric Furnace Co., Salem, O.
General Furnace Co.,
1015 Chestnut St., Philadelphia, Pa.
Pittsburgh Electric Furnace Corp.,
Union Bank Bldg., Pittsburgh, Pa.
Swindell, Wm., & Bros.,
P. O. Box 1753, Pittsburgh, Pa.

FURNACES (Electric for Annealing, Hardening, Drawing, Carbonizing)
Electric Furnace Co., Salem, O.
Holcroft & Co.,
6545 Epworth Blvd., Detroit, Mich.
Swindell, Wm., & Bros.,
P. O. Box 1753, Pittsburgh, Pa.
Whiting Corporation, Harvey, Ill.

FURNACES (Electric Melting)
Detroit Electric Furnace Co.,
2331 First National Bank Bldg.,
Detroit, Mich.
Electric Furnace Co., Salem, O.
General Furnace Co.,
1015 Chestnut St., Philadelphia, Pa.
Pittsburgh Electric Furnace Corp.,
Union Bank Bldg., Pittsburgh, Pa.
Swindell, Wm., & Bros.,
P. O. Box 1753, Pittsburgh, Pa.

FURNACES (Malleable Melting)
Whiting Corporation, Harvey, Ill.

FURNACES (Melting)
Coleman, F. A., Co.,
6539 Metta Ave., Cleveland, O.
Electric Furnace Co., Salem, O.
Detroit Electric Furnace Co.,
2331 First National Bank Bldg.,
Detroit, Mich.
Foundry Equipment Co.,
1831 Columbus Road, Cleveland, O.
Holcroft & Co.,
6545 Epworth Blvd., Detroit, Mich.
Paxson, J. W., Co.,
Nicetown Lane and D St., Philadelphia, Pa.
Pittsburgh Electric Furnace Corp.,
Union Bank Bldg., Pittsburgh, Pa.
Stevens, Frederic B., Inc.,
Third and Larned Sts., Detroit, Mich.
Swindell, Wm., & Bros.,
P. O. Box 1753, Pittsburgh, Pa.
Whiting Corporation, Harvey, Ill.

FURNACES (Open Hearth)
Swindell, Wm., & Bros.,
P. O. Box 1753, Pittsburgh, Pa.

GAGGERS (Steel)
Franklin Core Rod & Gagger Co.,
Franklin, Pa.
Truscon Steel Co., Youngstown, Ohio.
United Compound Co.,
228 Elk St., Buffalo, N. Y.

GAS BOOSTERS (Rotary)
Roots, P. H. & F. M., Co.,
Connersville, Ind.
Sturtevant, B. F., Co.,
Hyde Park, Boston, Mass.

GAS EXHAUSTERS (Rotary Positive Pressure)
Roots, P. H. & F. M., Co.,
Connersville, Ind.
Sturtevant, B. F., Co.,
Hyde Park, Boston, Mass.

GAS PUMPS (Rotary, Positive Pressure)
Roots, P. H. & F. M., Co.,
Connersville, Ind.

GAUGES (Welding)
Oxweld Acetylene Co.,
646 Frelinghuysen Ave., Newark, N. J.

GEAR HOBBERS
Adams Co., The,
175 Foster St., Dubuque, Iowa.

GEAR TESTERS
Adams Co., The,
175 Foster St., Dubuque, Iowa.

GLOVES (Sand Blast)
Pangborn Corporation,
P. O. Box 851, Hagerstown, Md.
Sly, W. W., Mfg. Co., The,
4702 Train Ave., Cleveland, O.

GOGGLES AND EYE PROTECTORS
Oxweld Acetylene Co.,
646 Frelinghuysen Ave., Newark, N. J.
Safety Equipment Service Co.,
1228 St. Clair Ave., Cleveland, O.

GRAPHITE
Hill & Griffith Co., Cincinnati, O.
Paxson, J. W., Co.,
Nicetown Lane and D St., Philadelphia, Pa.
Pettinos, George F.,
1206 Locust St., Philadelphia, Pa.

GRAPHITE (Boiler and Lubricating)
Dixon, Jos., Crucible Co., Jersey City, N. J.
Pettinos, George F.,
1206 Locust St., Philadelphia, Pa.

GRAPHITE PRODUCTS (Special Shapes)
Gautier, J. H., & Co.,
Greene St., Jersey City, N. J.

GRINDERS (Electric Portable)
Strand, N. A., & Co.,
5001-5009 North Lincoln St., Chicago, Ill.

GRINDERS (Emery)
Royersford Foundry & Machine Co.,
Royersford, Pa.

GRINDERS (Pneumatic Portable)
Cleveland Pneumatic Tool Co.,
3734 E. 78th St., Cleveland, O.
Ingersoll-Rand Co.,
11 Broadway, New York City.

GRINDING MACHINES
Bridgeport Safety Emery Wheel Co., Inc.,
Bridgeport, Conn.
Cleveland Armature Works,
4723-4736 St. Clair Ave., Cleveland, O.
Norton Co., Worcester, Mass.

GRINDING PANS (Sand)
National Engineering Co.,
549 W. Washington Blvd., Chicago, Ill.
Phillips & McLaren Co.,
24th and Smallman Sts., Pittsburgh, Pa.

GRINDING WHEELS—See ABRASIVE WHEELS

GRIT (Angular and Steel)
Pangborn Corp.
P. O. Box 851, Hagerstown, Md.

GUNS (Sand-Blast)
Pangborn Corporation,
P. O. Box 851, Hagerstown, Md.

GUNS (Spray) See SPRAY GUNS

HAMMERS (Air Forging)
Sullivan Machinery Co.,
122 S. Michigan Ave., Chicago, Ill.

HAMMERS (Chipping and Riveting—Pneumatic)
Cleveland Pneumatic Tool Co.,
3734 E. 78th St., Cleveland, O.
Ingersoll-Rand Co.,
11 Broadway, New York City.

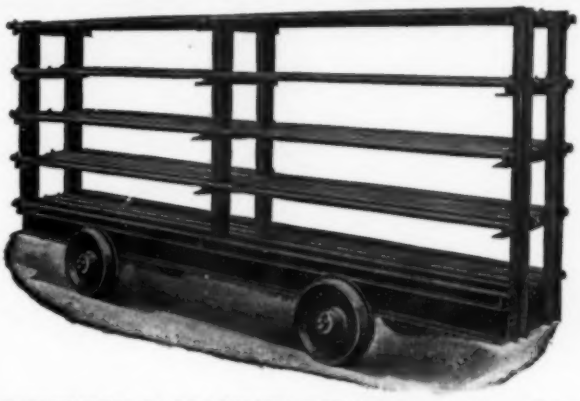
HANGERS (Roller Bearing for Line Shafts)
Hyatt Roller Bearing Co., Newark, N. J.

HARDNESS TESTING & HEAT MEASURING INSTRUMENTS
Shore Instrument & Mfg. Co., Inc.,
Van Wyck Ave. & Carll St.
Jamaica, L. I., New York.

HEATERS (Fan Blast)
Skinner Bros. Mfg. Co., Inc.,
1474 S. Vandeventer Ave., St. Louis, Mo.

HEATING SYSTEMS
Skinner Bros. Mfg. Co., Inc.,
1474 S. Vandeventer Ave., St. Louis, Mo.
Sturtevant, B. F., Co.,
Hyde Park, Boston, Mass.

We manufacture a complete line of Core Cars, Core Racks, Mold Drying Cars, Charging Cars, Scrap and Pig Iron Cars, General Purpose Cars of all kinds for all purposes.



Wheels and Axles, Turntables, Switches, Portable and Stationary Trackage.

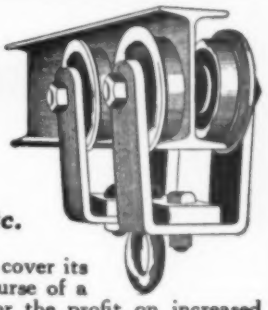
Let us have your specifications.

THE CHASE FOUNDRY & MANUFACTURING CO., COLUMBUS, OHIO

CURTIS
AIR COMPRESSORS-HOISTS-TROLLEYS-CRANES
ST. LOUIS
Curtis Pneumatic Machinery Co.
1545 Kienlen Ave. St. Louis, Mo.

SHEPARD
ELECTRIC CRANES & HOISTS
Electric hoists in capacities to 10 tons—floor and cage operated types. Electric Traveling Cranes to 30 tons. Electric Cupola Charging Hoists. Complete Monorail Systems. Write for bulletins.
SHEPARD ELECTRIC CRANE & HOIST CO.
360 Schuyler Ave. Montour Falls, N. Y.

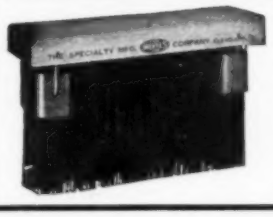
I-BEAM ROLLER BEARING TROLLEYS



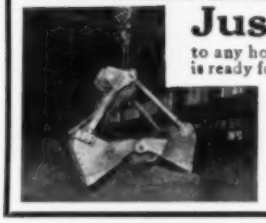
Overhead Switches Turntables, Hangers, etc.

A Randall Tramrail System will cover its cost many times over in the course of a year by the savings in wages, or the profit on increased output of your plant. ¶May we send our latest catalog?

Randall Tramrail Company
331-333 N. Second St. PHILADELPHIA, PA.

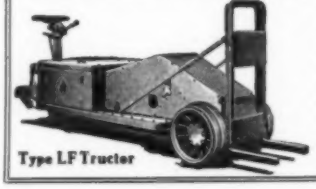


EVEN TRIM CASTING BRUSHES
Every wire the same length.
Every hole filled with the same number of wires.
Can you say this about the brushes you are using?
Are you getting full weight brushes?
Samples sent upon request.
The Specialty Mfg. Co.
11400 Madison Ave., Cleveland, Ohio



Just hook it on
to any hoisting unit, and the WILLIAMS Foundry bucket is ready for instant use. Has "*all parts guaranteed against breakage, as long as used on the classes of work it is recommended for.* Write for catalog F.
G. H. Williams Co., 612 Haybarger Lane, Erie, Pa.
WILLIAMS
QUICK-ACTING CLAMSHELLS

ELWELL-PARKER ELECTRIC FURNACE CHARGER
for
MALLEABLE ANNEALING OVENS



Type LF Tructor

Proven the cheapest and most efficient method. ¶Tructors for every industrial haulage requirement, crane, tractor, platform, dump, and electric lift for transfer or stacking. ¶Request Catalogue 314.
The ELWELL-PARKER ELECTRIC CO
Cleveland, Ohio

INDUSTRIAL CRANES
17 Locomotive Types - 5 to 200 Tons
INDUSTRIAL WORKS
BAY CITY MICHIGAN

Dumping Buckets FOR ALL USES Industrial Cars or Trucks
PENN FOUNDRY & MFG. CO., Evans Ave., Reading, Pa.

HELMETS (Sand Blast)
Koven, L. O., & Brother, Inc., 154 Ogden Ave., Jersey City, N. J.
Macleod Co., 2225 Bogen St., Cincinnati, O.
Pangborn Corp., P. O. Box 851, Hagerstown, Md.
Paxson, J. W., Co., Nicetown Lane and D St., Philadelphia, Pa.
Safety Equipment Service Co., 1228 St. Clair Ave., Cleveland, O.
Sly, W. W., Mfg. Co., The, 4702 Train Ave., Cleveland, O.
Tilghman-Brooksbank Sand Blast Co., 1122 So. 11th St., Philadelphia, Pa.

HOISTING MACHINERY
Cleveland Crane & Engineering Co., Wickliffe, O.
Motorbloc Corp., Summerdale, Philadelphia, Pa.

HOISTS (Air)
Hanna Engineering Works, 1765 Elston Ave., Chicago, Ill.
Independent Pneumatic Tool Co., 600 W. Jackson Blvd., Chicago, Ill.
Ingersoll-Rand Co., 11 Broadway, New York City.
Northern Engineering Works, 2605 Atwater Bldg., Detroit, Mich.
Whiting Corporation, Harvey, Ill.

HOISTS (Electric)
American Engineering Co., Cumberland and Aramingo Sts., Philadelphia, Pa.
Link-Belt Co., 910 South Michigan Ave., Chicago, Ill.
Northern Engineering Works, 2605 Atwater Bldg., Detroit, Mich.
Pawling & Harnischfeger Co., 3805 National Ave., Milwaukee, Wis.
Shepard Electric Crane & Hoist Co., Montour Falls, N. Y.

HOISTS (Monorail)
American Engineering Co., Cumberland and Aramingo Sts., Philadelphia, Pa.

HOISTS (Pneumatic)
Ingersoll-Rand Co., 11 Broadway, New York City.
Whiting Corp., Harvey, Ill.

HOISTS (Skip)
Bartlett, C. O., & Snow Co., French and Winter Sts., Cleveland, O.

HOODS (Leather Sand-Blast)
Pangborn Corporation, P. O. Box 851, Hagerstown, Md.

HOSE (Sand Blast)
Koven, L. O., & Brother, Inc., 154 Ogden Ave., Jersey City, N. J.
Macleod Co., 2225 Bogen St., Cincinnati, O.
Pangborn Corporation, P. O. Box 851, Hagerstown, Md.
Paxson, J. W., Co., Nicetown Lane and D St., Philadelphia, Pa.
Sly, W. W., Mfg. Co., The, 4702 Train Ave., Cleveland, O.

HOSE (Welding)
Oxweld Acetylene Co., 646 Frelinghuysen Ave., Newark, N. J.

HOSE CLAMPS
Malleable Iron Fittings Co., Branford, Conn.

HOSE COUPLINGS (Pneumatic)
Cleveland Pneumatic Tool Co., 3734 E. 78th St. S. E., Cleveland, O.

HUMIDIFYING APPARATUS
Sturtevant, B. F., Co., Hyde Park, Boston, Mass.

INDUSTRIAL RAILWAY EQUIPMENT—See RAILWAY EQUIPMENT

INGOTS (Aluminum)
British Aluminum Co., Ltd., 165 Broadway, New York City.

INGOTS (Brass, Bronze, Copper, Nickel)
Ajax Metal Co., 46 Richmond St., Philadelphia, Pa.

JACKETS (Steel)
Adams Co., The, 175 Foster St., Dubuque, Iowa.
Truscon Steel Co., Youngstown, Ohio.

JACKETS (Snap Flask Mold)
American Foundry Equipment Co., The, 368 Madison Ave., New York City.

JOLT RAMMER MACHINES (Pneumatic)
Grimes Molding Machine Co., 5736 Hastings St., Detroit, Mich.

JOLT RAMMING MACHINES (Pneumatic and Electric)
American Foundry Equipment Co., The, 368 Madison Ave., New York City.
Arcade Mfg. Co., Dept. D, Freeport, Ill.
Herman Pneumatic Machine Co., Union Bank Bldg., Pittsburgh, Pa.

LADLES
Paxson, J. W., Co., Nicetown Lane and D St., Philadelphia, Pa.
Stevens, Frederic B., Inc., Third and Larned Sts., Detroit, Mich.
Truscon Steel Co., Youngstown, Ohio.
Whiting Corp., Harvey, Ill.

LADLES (Truck)
Scully-Jones & Co., 2012 W. 13th St., Chicago, Ill.
Whiting Corp., Harvey, Ill.

LADLE HEATERS AND DRYERS
Hauck Mfg. Co., 126 Tenth St., Brooklyn, N. Y.
Macleod Co., 2225 Bogen St., Cincinnati, O.

LEAD
Hill & Griffith Co., Cincinnati, O.
Pettinos, George F., 1206 Locust St., Philadelphia, Pa.
Stevens, Frederic B., Inc., Third and Larned Sts., Detroit, Mich.

LEAD BURNING APPARATUS (Oxy-Acetylene)
Oxweld Acetylene Co., 646 Frelinghuysen Ave., Newark, N. J.

LEG & FOOT PROTECTORS
Safety Equipment Service Co., 1228 St. Clair Ave., Cleveland, O.

LIMESTONE
Bethlehem Steel Co., Betblehem, Pa.

LINE SHAFT BEARINGS (Roller)
Hyatt Roller Bearing Co., Newark, N. J.

LINSEED OIL (Core)
Kellogg, Spencer, & Sons, Inc., Buffalo, N. Y.
Smith, Werner G., 2191 W. 110th St., Cleveland, O.

LITHOPHONE
New Jersey Zinc Co., 160 Front St., New York City.

LOADERS (Wagon and Trucks)
Link-Belt Co., 910 South Michigan Ave., Chicago, Ill.

LOCOMOTIVES (Electric)
General Electric Co., Schenectady, N. Y.

LUMBER (Crating)
Dock & Mill Company, 126 Main St., N. Tonawanda, N. Y.

LUMBER (Flask)
Dock & Mill Company, 126 Main St., N. Tonawanda, N. Y.

LUMBER (Template)
Dock & Mill Company, 126 Main St., N. Tonawanda, N. Y.

MACHINERY (Material Handling)
Industrial Works, Bay City, Mich.

MAGNETIC SEPARATORS—See SEPARATORS (Magnetic)

MANIFOLDS (Oxygen)
Oxweld Acetylene Co., 646 Frelinghuysen, Ave., Newark, N. J.

MATCH PLATES
Ashland Brass Foundry, Virginia Ave., Ashland, Ohio.

METALLURGISTS
Babcock Testing Laboratory, Lackawanna, N. Y.
Kawin, Charles C., Co., 431 South Dearborn St., Chicago, Ill.
Rohmer, Gabriel E., 516 5th Ave., New York City.

METAL LATH
Truscon Steel Co., Youngstown, O.

METALS (Nonferrous)
Ajax Metal Co., 46 Richmond St., Philadelphia, Pa.
Titanium Alloy Mfg. Co., The, Niagara Falls, N. Y.

METERS (Cupola)
Bacharach Industrial Instrument Co., 7000 Bennett St., Pittsburgh, Pa.

MICA SCHISTS LINING
Paxson, J. W., Co., Nicetown Lane and D St., Philadelphia, Pa.

MILLING ATTACHMENTS FOR PLANERS
Adams Co., The, 175 Foster St., Dubuque, Iowa.

MILLING STARS AND JACKS—See STARS (Tumbling Mill)

MILLS (Sand Mixing and Compounding)
National Engineering Co., 549 W. Washington Blvd., Chicago, Ill.

MIXERS (Sand)—See SAND MIXING MACHINERY

MOLASSES (Foundry)
Mifflin Chemical Corp., Delaware Ave. & Tasker St., Philadelphia, Pa.

MOLD DRYERS
Young Brothers Co., 6508 Mack Ave., Detroit, Mich.

MOLD OVENS
Foundry Equipment Co., 1831 Columbus Road, Cleveland, O.
Sly, W. W., Mfg. Co., The, 4702 Train Ave., Cleveland, O.
Swartwout Co., 18511 Euclid Ave., Cleveland, O.
Whiting Corp., Harvey, Ill.
Young Brothers Co., 6508 Mack Ave., Detroit, Mich.

MOLDING MACHINES
Adams Co., The, 175 Foster St., Dubuque, Iowa.
American Foundry Equipment Co., The, 368 Madison Ave., New York City.
Arcade Mfg. Co., Dept. D, Freeport, Ill.
Beardsley & Piper Co., 2541 No. Keeler Ave., Chicago, Ill.
Davenport Machine & Foundry Co., Davenport, Iowa.
Federal Malleable Co., West Allis, Wis.
Grimes Molding Machine Co., 5736 Hastings St., Detroit, Mich.
Hanna Engineering Works, 1759 Elston Ave., Chicago, Ill.
Herman Pneumatic Machine Co., Union Bank Bldg., Pittsburgh, Pa.
Moline Iron Works, Moline, Ill.

MOLDING MACHINES (Roll Over)
Adams Co., The, 175 Foster St., Dubuque, Iowa.
Arcade Mfg. Co., Dept. D, Freeport, Ill.
Davenport Machine & Foundry Co., Davenport, Iowa.
Herman Pneumatic Machine Co., Union Bank Bldg., Pittsburgh, Pa.

MOLDING MACHINES (Squeezer)
Adams Co., The, 175 Foster St., Dubuque, Iowa.
Arcade Mfg. Co., Dept. D, Freeport, Ill.
Berkshire Mfg. Co., Whitney Power Block, Cleveland, Ohio.
Federal Malleable Co., West Allis, Wis.
Grimes Molding Machine Co., 5736 Hastings St., Detroit, Mich.
Moline Iron Works, Moline, Ill.

MOLDING MACHINES (Tractor Type Sand Throwing)
Beardsley & Piper Co., 2541 No. Keeler Ave., Chicago, Ill.

MONEL METAL
International Nickel Co., 67 Wall St., New York City.

MOTORS (Electric)
Sturtevant, B. F., Co., Hyde Park, Boston, Mass.

Maximum efficiency demands good working conditions—

Get Rid of Dust!

Dust has a remarkable ability to impair production. Workmen dislike it—and it affects their health to such an extent that the daily production per man is not nearly what it would be if working conditions were right.

You can equip your cleaning room with a "*Morse*" *Rarefied Dust Collector* and keep the air clean at a negligible cost.

THE "MORSE" RAREFIED DUST COLLECTOR

The "*Morse*" is a very simple and durable apparatus. It has no moving parts—and no screens or cloths to fill up or cut through.

The installation is made between the source of dust and the fan. The air is drawn through the collector, and a constant vacuum tendency in the collector casing is maintained. The dust is discharged automatically before the air reaches the fan—a feature that saves cutting out of fan and consequent repairs.

Write for our catalog—and get the full details.

The Knickerbocker Company

JACKSON 516 Liberty St. MICHIGAN

SALESMAN OR SALES MANAGER

Whether you are a salesman or a sales manager, a general manager, an officer or a director of your company you should be represented by a good card—**the best card**

PEERLESS PATENT BOOK FORM CARD

Appearance of Our Neat Card in Case

That they are the best admits of no discussion. The best men everywhere use them. If you don't it is only because you have not examined them. They are always carried together and they carry conviction. They are always smooth edged when you detach them; and they are always clean and flat. They leave nothing to be desired, however fastidious the taste, or severely critical the judgment.

Send today for sample tab and detach the cards one by one—satisfy yourself as to what others universally call best.

Send Today

THE JOHN B. WIGGINS COMPANY

Engravers Die Embossers Plate Printers

705 People's Gas Bldg. CHICAGO 1104 So. Wabash Ave.

Maximum Service ***Minimum Cost***

BUILDING STANDARDIZATION

Let us show you what can be done by our Standard Modern Foundry Construction.

The Beling-Bush Co., Inc.

Industrial Engineers and Builders

Drexel Bldg., Philadelphia, Pa.

NAILS
Fowler & Union Horse Nail Co., 1000 Military Road, Buffalo, N. Y.

NICKEL
International Nickel Co., 67 Wall St., New York City.

NICKEL (Boronic)
American Boron Products Co., Inc., Reading, Pa.

NOZZLES (Sand Blast)
Koven, L. O., & Brother, Inc., 154 Ogden Ave., Jersey City, N. J.
Macleod Co., 2225 Bogen St., Cincinnati, O.
Pangborn Corp., P. O. Box 851, Hagerstown, Md.
Sly, W. W., Mfg. Co., The, 4702 Train Ave., Cleveland, O.

OIL (Core)—See CORE OIL

OIL BURNING INSTALLATIONS
Foundry Equipment Co., The, 1831 Columbus Rd., Cleveland, O.
Hauck Mfg. Co., 126 Tenth St., Brooklyn, N. Y.

OVENS (Annealing)
Whiting Corporation, Harvey, Ill.

OVENS (Core) See CORE OVENS

OVENS (Enameling, Japanning, Etc.)
Foundry Equipment Co., 1831 Columbus Road, Cleveland, O.
Swartwout Co., 18511 Euclid Ave., Cleveland, O.
Young Brothers Co., 6508 Mack Ave., Detroit, Mich.

OVENS (Mold)—See MOLD OVENS

OXY-ACETYLENE EQUIPMENT — See WELDING AND CUTTING EQUIPMENT (Oxy-Acetylene)

OXY-ACETYLENE WELDING AND CUTTING—See WELDING AND CUTTING APPARATUS AND SUPPLIES (Oxy-Acetylene Process)

OXYGEN AND HYDROGEN
International Oxygen Co., Newark, N. J.

OXY-HYDROGEN WELDING AND CUTTING EQUIPMENT — See WELDING AND CUTTING EQUIPMENT (Oxy-Hydrogen)

PAINT PIGMENTS
New Jersey Zinc Co., 160 Front St., New York City.

PAINTS
Truscon Steel Co., Youngstown, Ohio.

PANS (Grinding)—See GRINDING PANS (Sand)

PANS (Steel)
Truscon Steel Co., Youngstown, Ohio.

PANS (Tempering)
National Engineering Co., 549 W. Washington Blvd., Chicago, Ill.
Phillips & McLaren Co., 24th and Smallman Sts., Pittsburgh, Pa.

PAPER (Abrasive)
Carborundum Co., Niagara Falls, N. Y.

PARTING COMPOUNDS
Hill & Griffith Co., Cincinnati, O.
Paxson, J. W., Co., Nicetown Lane and D St., Philadelphia, Pa.
Pettinos, George F., 1206 Locust St., Philadelphia, Pa.
Stevens, Frederic B., Inc., Third and Larned Sts., Detroit, Mich.

PARTITIONS (Rolled Steel)
Truscon Steel Co., Youngstown, Ohio.

PATTERNS (Wood, Metal)
Arcade Mfg. Co., Dept. D, Freeport, Ill.
Herman Pneumatic Machine Co., Union Bank Bldg., Pittsburgh, Pa.

PATTERN COMPOUND
American Foundry Equipment Co., The, 368 Madison Ave., New York City.

PATTERN LETTERS
Chain Products Co., 2924 Cooper Ave., Cleveland, O.
Paxson, J. W., Co., Nicetown Lane and D St., Philadelphia, Pa.

PATTERN LUMBER
Dock & Mill Co., 126 Main St., N. Tonawanda, N. Y.

PATTERN MAKERS' EQUIPMENT AND SUPPLIES
Wellman Products Co., 1444 E. 49th St., Cleveland, O.

PATTERN-MAKERS OUTFITS (Flexible Shaft)
Hergi Mfg. Co., 250 Fifth St., Bridgeport, Conn.

PATTERN PLATES (Steel)
Ashland Brass Foundry, Virginia Ave., Ashland, Ohio.
Truscon Steel Co., Youngstown, O.

PATTERN SHOP EQUIPMENT
Oliver Machinery Co., Grand Rapids, Mich.

PATTERN SHOP SUPPLIES AND EQUIPMENT
Hergi Mfg Co., 250 Fifth St., Bridgeport, Conn.
Paxson, J. W., Co., Nicetown Lane and D St., Philadelphia, Pa.

PATTERN WAX
United Compound Co., 228 Elk St., Buffalo, N. Y.

PIG IRON
Bethlehem Steel Co., Bethlehem, Pa.
Hanna, M. A., Co., The, Leader-News Bldg., Cleveland, O.
Pilling & Co., 1315 Walnut St., Philadelphia, Pa.
Rogers, Brown & Co., 433 Vine St., Cincinnati, O.

PLATES (Bottom Snap Flask)
Diamond Clamp & Flask Co., Richmond, Ind.
Truscon Steel Co., Youngstown, Ohio.

PLATES (Circular and Disk, Steel)
Truscon Steel Co., Youngstown, Ohio.

PLATES (Core Drying)
Truscon Steel Co., Youngstown, Ohio.

PLATES (Rapping)
Paxson, J. W., Co., Nicetown Lane and D St., Philadelphia, Pa.

PLATES (Steel Pattern)
Truscon Steel Co., Youngstown, Ohio.

PLUMBAGO
Dixon, Jos., Crucible Co., Jersey City, N. J.
Hill & Griffith Co., Cincinnati, Ohio.
Paxson, J. W., Co., Nicetown Lane and D St., Philadelphia, Pa.
Pettinos, George F., 1206 Locust St., Philadelphia, Pa.
Stevens, Frederic B., Inc., Third and Larned Sts., Detroit, Mich.
United States Graphite Co., Saginaw, Mich.

PNEUMATIC TOOLS—See TOOLS (Pneumatic)

POLISHERS' AND PLATERS' SUPPLIES
Stevens, Frederic B., Inc., Third and Larned Sts., Detroit, Mich.

POWDERED COAL PLANTS
Fuller Engineering Co., Fullerton, Pa.
Grindle Fuel Equipment Co., Harvey, Ill.

POWER SQUEEZERS—See SQUEEZERS (Power)

POWER TRANSMISSION MACHINERY
Royersford Foundry & Machine Co., Royersford, Pa.

PRESSED STEEL
Truscon Steel Co., Youngstown, O.

PULLEYS (Magnetic)
Dings Magnetic Separator Co., 675 Smith St., Milwaukee, Wis.

PULVERIZED COAL SYSTEMS
Grindle Fuel Equipment Co., Harvey, Ill.

PUMPS
Ingersoll-Rand Co., 11 Broadway, New York City.
Roots, P. H. & F. M., Co., Connersville, Ind.

PUMPS (Air Lift)
Ingersoll-Rand Co., 11 Broadway, New York City.
Sullivan Machinery Co., 122 S. Michigan Ave., Chicago, Ill.

PUMPS (Dry Vacuum)
Sullivan Machinery Co., 122 S. Michigan Ave., Chicago, Ill.

PUMPS (Hydraulic)
American Engineering Co., Cumberland and Aramingo Sts., Philadelphia, Pa.
Roots, P. H. & F. M., Co., Connersville, Ind.

PUMPS (Mine)
Roots, P. H. & F. M., Co., Connersville, Ind.

PUMPS (Oil and Tar)
Roots, P. H. & F. M., Co., Connersville, Ind.

PUMPS (Power)
Roots, P. H. & F. M., Co., Connersville, Ind.

PUMPS (Rotary Pressure)
Roots, P. H. & F. M., Co., Connersville, Ind.

PUMPS (Rotary Vacuum)
Roots, P. H. & F. M., Co., Connersville, Ind.

PUMPS (Vacuum)
Ingersoll-Rand Co., 11 Broadway, New York City.

PUMPS (Vacuum-Filtration)
Roots, P. H. & F. M., Co., Connersville, Ind.

PUNCHES & SHEARS
Royersford Foundry & Machine Co., Royersford, Pa.

PYOMETER TUBES
Norton Co., Worcester, Mass.

PYROMETERS
Bacharach Industrial Equipment Co., 7000 Bennett St., Pittsburgh, Pa.

PYROSCOPES
Shore Instrument & Mfg. Co., Inc., Van Wyck Ave. and Carll St., Jamaica, L. I., New York.

RAILWAY EQUIPMENT (Cars, Industrial, etc.)
Bethlehem Steel Co., Bethlehem, Pa.
Chase Foundry & Mfg. Co., The, Columbus, Ohio.

RAMMERS (Pneumatic)
Independent Pneumatic Tool Co., 600 W. Jackson Blvd., Chicago, Ill.

RAMMERS (Sand Pneumatic)—See SAND RAMMERS (Pneumatic)

RECLAIMING (Iron and Sand)
Dings Magnetic Separator Co., 675 Smith St., Milwaukee, Wis.

REFRACTORIES
Carborundum Co., Niagara Falls, N. Y.
Norton Co., Worcester, Mass.

REFRACTORIES (Special Shapes)
Gautier, J. H., & Co., Greene St., Jersey City, N. J.

REGULATORS (Compressed Air)
Oxweld Acetylene Co., 646 Frelinghuysen Ave., Newark, N. J.

RESPIRATORS
Pangborn Corporation, P. O. Box 851, Hagerstown, Md.

RIDDLES
Hill & Griffith Co., Cincinnati, Ohio.
Malleable Iron Fittings Co., Branford, Conn.
Paxson, J. W., Co., Nicetown Lane and D St., Philadelphia, Pa.
Pettinos, George F., 1206 Locust St., Philadelphia, Pa.
Vibrating Machinery Co., 546 W. Jackson Blvd., Chicago, Ill.

RIVETERS—See HAMMERS (Chipping and Riveting—Pneumatic)

RODS (Iron and Steel)
Bethlehem Steel Co., Bethlehem, Pa.

ROLLER BEARINGS
Hyatt Roller Bearing Co., Newark, N. J.

ROSIN
Hercules Powder Co., Wilmington, Del.

RUBBER PIGMENTS
New Jersey Zinc Co., 160 Front St., New York City.

SAFETY EQUIPMENT SUPPLIES
Safety Equipment Service Co., 1228 St. Clair Ave., Cleveland, O.

SAND
Buckeye Sand Co., Conneaut, Ohio.
Cape May Sand Co., Cape May, N. J.
Cumberland Sand Co., 5 Main St., Massillon, O.

MODERN FOUNDRY SAND HANDLING EQUIPMENT, MECHANICAL AND STRUCTURAL ENGINEER.

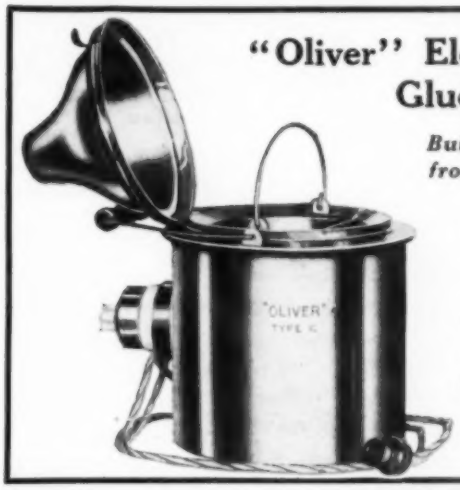
Age 37, expert on elevating and conveying machinery, especially in connection with sand conveying and preparing systems for foundries, having handled large installations successfully. Able to interview prospective customers, to make proposals, drawings and estimates, to make final layouts, shop drawings, to supervise installation and to start operation of equipment.

Wishes either: Position with conveying machinery manufacturers to introduce and handle foundry jobs; or to open branch office for some manufacturer for the same purpose; or to connect with a financially responsible party as a partner, either active or silent, to establish an engineering business in this promising field. Replies held strictly confidential. Address box No. 592, care The Foundry, 1147 Peoples Gas Bldg., Chicago.

As the year draws to a close we take the occasion to thank our good customers for the business we have enjoyed and wish them all success for the years to come.

THE CLEVELAND STEEL TOOL CO.
Punches. Dies. Chisels. Rivet Sets
660 E. 82nd St. Cleveland, O.

BUY YOUR
PATTERN, FLASK AND TEMPLATE LUMBER
FROM
DOCK & MILL CO.
NORTH TONAWANDA, N. Y.



"Oliver" Electric Glue Heaters

Built in sizes from 1 pint up

Hinged cover
Heat-retaining jacket
No water to run dry
No burn-outs
Very economical
Priced Low—

Oliver Mchy. Co.
Grand Rapids, Michigan

$24.00 each **$24.00 each**

CASTINGS—MATCHPLATES
Brass—Bronze—Aluminum

We specialize in Aluminum Match Plate Patterns, Twin Plates, Sheave Plates or Three Way Work Rolled Once. Blank aluminum Plates any size or thickness, lighter than steel or cast iron and will not rust, and Jack Star Plates $15.00 each. Compare your costs with our prices before ordering—write for literature today.

ASHLAND BRASS FOUNDRY, ASHLAND, O., U. S. A.

The first and only book on moulding machines
FOUNDRY MOULDING MACHINES AND PATTERN EQUIPMENT
By E. S. CARMAN
A 225-page book full of data on Foundry Moulding Machines and the equipment necessary for their use. 220 Illustrations
Price $5.00, (25s.) postpaid
THE PENTON PUBLISHING CO.
enton Bldg., Lakeside Ave. & W. 3rd St. Book Department Cleveland, O. 528 IF

Pattern Makers "Pal" Portable Outfit

Saves Time and Money
See full particulars in our adv. first of each month in The Foundry.

THE HERGI MFG. CO. Bridgeport, Conn.

BUCKEYE MOULDING AND CORE SANDS
For
Malleable Brass, Aluminum and Grey Iron Work
BUCKEYE SAND COMPANY
Conneaut, Ohio

PATTERN LETTERS
THE CHAIN PRODUCTS CO., Cleveland, Ohio, U. S. A.

THE CUMBERLAND SAND COMPANY
Producers & Shippers
GRAY IRON MOULDING SAND

Office Massillon, O.
Quarry New Cumberland, O
MASSILLON OHIO
Cleveland Office B. L. Chamberlin 10121 Born Ave.

MOLDING SANDS
Just a little better than the sands you thought were best
THE SUPERIOR SAND CO.
511 Guardian Building CLEVELAND, OHIO

EVERYTHING REQUIRED IN YOUR PATTERN DEPARTMENT
From Electrical Equipment to Hand Tools used by your men.

Brass Dowel Pins—The lowest prices and most accurate fitting Dowel Pin on the market. Compare bit sizes as well as prices in placing your orders.

Pattern Letters—Fillet—Core Box Pins—Sheet and Cast Aluminum Plates — Special Screw Machine Parts made to order.

Send for catalog.

The Wellman Products Co.
1444 E. 49th St. Cleveland

Jones Sand Co.,
277 East Long St., Columbus, O.
Pangborn Corporation,
P. O. Box 851, Hagerstown, Md.
Paxson, J. W., Co.,
Nicetown Lane and D St., Philadelphia, Pa.
Pettinos, George F.,
1206 Locust St., Philadelphia, Pa.
Portage Silica Co., Youngstown, O.
Superior Sand Co.,
511 Guardian Bldg., Cleveland, O.
U. S. Silica Co.,
122 South Michigan Ave., Chicago, Ill.

SAND (Core)

Cape May Sand Co., Cape May, N. J.
Cumberland Sand Co.,
5 Main St., Massillon, O.
Portage Silica Co., Youngstown, O.
Standard Silica Co.,
108 S. La Salle St., Chicago, Ill.
U. S. Silica Co.,
122 South Michigan Ave., Chicago, Ill.
Whitehead Brothers Co.,
17 Exchange Place, Providence, R. I.

SAND (Molding)

Keener Sand & Clay Co.,
514 Hartman Bldg., Columbus, Ohio.
Paxson, J. W., Co.,
Nicetown Lane and D St., Philadelphia, Pa.
Pettinos, George F.,
1206 Locust St., Philadelphia, Pa.
Portage Silica Co., Youngstown, Ohio.
Standard Silica Co.,
108 S. La Salle St., Chicago, Ill.
U. S. Silica Co.,
122 South Michigan Ave., Chicago, Ill.
Whitehead Brothers Co.,
17 Exchange Place, Providence, R. I.

SAND (Sand Blast)

Cape May Sand Co., Cape May, N. J.
Pangborn Corp.,
P. O. Box 851, Hagerstown, Md.
Paxson, J. W., Co.,
Nicetown Lane and D St., Philadelphia, Pa.
Pettinos, George F.,
1206 Locust St., Philadelphia, Pa.
Portage Silica Co., Youngstown, O.
U. S. Silica Co.,
122 South Michigan Ave., Chicago, Ill.
Whitehead Brothers Co.,
17 Exchange Place, Providence, R. I.

SAND (Steel Molding)

Cape May Sand Co., Cape May, N. J.
Paxson, J. W., Co.,
Nicetown Lane and D St., Philadelphia, Pa.
Pettinos, George F.,
1206 Locust St., Philadelphia, Pa.
Portage Silica Co., Youngstown, O.
U. S. Silica Co.,
122 South Michigan Ave., Chicago, Ill.
Whitehead Brothers Co.,
17 Exchange Place, Providence, R. I.

SAND BLAST ABRASIVES (Steel Shot and Grit)

Globe Steel Abrasive Co., Dept. F,
Mansfield, O.
Pangborn Corporation,
P. O. Box 851, Hagerstown, Md.
Pittsburgh Crushed Steel Co.,
61st and A. V. Ry, Pittsburgh, Pa.
Standard Radial Blast Corp.,
519-30 Church St., New York City.

SAND BLAST EQUIPMENT AND ACCESSORIES

American Foundry Equipment Co., The,
368 Madison Ave., New York City.
Ingersoll-Rand Co.,
11 Broadway, New York City.
Koven, L. O., & Brother, Inc.,
154 Ogden Ave., Jersey City, N. J.
Macleod Co.,
2225 Bogen St., Cincinnati, O.
New Haven Sand Blast Co., The,
6 Church St., New Haven, Conn.
Pangborn Corporation,
P. O. Box 851, Hagerstown, Md.
Paxson, J. W., Co.,
Nicetown Lane and D St., Philadelphia, Pa.
Sly, W. W., Mfg. Co., The,
4702 Train Ave., Cleveland, O.
Standard Radial Blast Corp.,
519-30 Church St., New York City.
Tilghman-Brooksbank Sand Blast Co.,
1122 South 11th St., Philadelphia, Pa.

SAND BLAST NOZZLES—See NOZZLES (Sand Blast)

SAND BLAST SHOT (Steel)—See SHOT (Steel Sand Blast)

SAND BLAST TUMBLING BARRELS—See TUMBLING BARRELS

SAND CONVEYING AND HANDLING EQUIPMENT

Bartlett, C. O., & Snow Co.,
French and Winter Sts., Cleveland, O.
Link-Belt Co.,
910 South Michigan Ave., Chicago, Ill.
National Engineering Co.,
549 W. Washington Blvd., Chicago, Ill.
Standard Sand & Machine Co.,
5151 St. Clair Ave., Cleveland, O.

SAND CUTTING MACHINES

American Foundry Equipment Co., The,
368 Madison Ave., New York City

SAND CUTTING AND SCREENING MACHINES

Whiting Corp., Harvey, Ill.

SAND DRYERS

Bartlett, C. O., & Snow Co.,
French and Winter Sts., Cleveland, O.
Koven, L. O., & Brother, Inc.,
154 Ogden Ave., Jersey City, N. J.
Macleod Co.,
2225 Bogen St., Cincinnati, O.
Pangborn Corporation,
P. O. Box 851, Hagerstown, Md.

SAND GRINDING PANS—See GRINDING PANS (Sand)

SAND MIXING MACHINERY

American Foundry Equipment Co., The,
368 Madison Ave., New York City.
National Engineering Co.,
549 W. Washington Blvd., Chicago, Ill.
Standard Sand & Machine Co.,
5151 St. Clair Ave., Cleveland, O.

SAND RAMMERS (Pneumatic)

Cleveland Pneumatic Tool Co.,
3734 E. 78th St., Cleveland, O.
Ingersoll-Rand Co.,
11 Broadway, New York City.

SAND RECLAIMERS

Bartlett, C. O., & Snow Co.,
French and Winter Sts., Cleveland, O.
Dings Magnetic Separator Co.,
675 Smith St., Milwaukee, Wis.
Link-Belt Co.,
910 South Michigan Ave., Chicago, Ill.
National Engineering Co.,
549 W. Washington Blvd., Chicago, Ill.

SAND SIFTERS

Arcade Mfg. Co., Dept. D, Freeport, Ill.
Herman Pneumatic Machine Co.,
Union Bank Bldg., Pittsburgh, Pa.
National Engineering Co.,
549 W. Washington Blvd., Chicago, Ill.
Paxson, J. W., Co.,
Nicetown Lane and D St., Philadelphia, Pa.
Standard Sand & Machine Co.,
5151 St. Clair Ave., Cleveland, O.
Vibrating Machinery Co.,
546 W. Jackson Blvd., Chicago, Ill.

SAND SLINGERS

Beardsley & Piper Co.,
2541 No. Keeler Ave., Chicago, Ill.

SASH OPERATING DEVICES

Truscon Steel Co., Youngstown, O.

SASH (Steel) See STEEL SASH

SASH STEEL (Continuous)

Truscon Steel Co., Youngstown, O.

SCALING HAMMERS

Ingersoll-Rand Co.,
11 Broadway, New York City.

SCLEROSCOPES

Shore Instrument & Mfg. Co., Inc.,
Van Wyck Ave. & Carll St.,
Jamaica, L. I., New York.

SCREENS (Sand)

National Engineering Co.,
549 W. Washington Blvd., Chicago, Ill.
Standard Sand & Machine Co., The,
5151 St. Clair Ave., Cleveland, O.

SEACOAL

Hill & Griffith Co., Cincinnati, Ohio.
Paxson, J. W., Co.,
Nicetown Lane and D St., Philadelphia, Pa.
Stevens, Frederic B., Inc.,
Third and Larned Sts., Detroit, Mich.

SEPARATORS (Air Moisture)

Swartwout Co.,
18511 Euclid Ave., Cleveland, O.

SEPARATORS (Magnetic)

Dings Magnetic Separator Co.,
675 Smith St., Milwaukee, Wis.
Magnetic Mfg. Co.,
Windlake & 4th Aves., Milwaukee, Wis.
Paxson, J. W., Co.,
Nicetown Lane and D St., Philadelphia, Pa.

SEPARATORS (Magnetic and Electro Magnetic of all Kinds)

Dings Magnetic Separator Co.,
675 Smith St., Milwaukee, Wis.

SEPARATORS (Moisture-Oil)

Pangborn Corporation,
P. O. Box 851, Hagerstown, Md.
Swartwout Co.,
18511 Euclid Ave., Cleveland, O.

SEPARATORS (Sand)

Dings Magnetic Separator Co.,
675 Smith St., Milwaukee, Wis.
National Engineering Co.,
549 W. Washington Blvd., Chicago, Ill.
Pangborn Corporation,
P. O. Box 851, Hagerstown, Md.
Sly, W. W., Mfg. Co., The,
4702 Train Ave., Cleveland, O.

SHAFTING HANGERS (Roller Bearing)

Hyatt Roller Bearing Co., Newark, N. J.

SHAKE-OUT FLOORS (Pneumatic)

Pangborn Corporation,
P. O. Box 851, Hagerstown, Md.

SHOT AND GRIT (Sand Blast)

Globe Steel Abrasive Co., Dept. F,
Mansfield, Ohio.
Pangborn Corporation,
P. O. Box 851, Hagerstown, Md.

SHOT (Steel, Sand Blast)

Pangborn Corporation,
P. O. Box 851, Hagerstown, Md.
Steel Shot & Grit Co.,
61st and A. V. Ry., Pittsburgh, Pa.

SHOVELS

Hill & Griffith Co., Cincinnati, Ohio.

SILICA (Ground and Grits)

Paxson, J. W., Co.,
Nicetown Lane and D St., Philadelphia, Pa.
U. S. Silica Co.,
122 South Michigan Ave., Chicago, Ill.

SLAB ZINC (Spelter)

New Jersey Zinc Co.,
160 Front St., New York City.

SLIP JACKETS (Steel)

Adams Co., The,
175 Foster St., Dubuque, Iowa.
Truscon Steel Co., Youngstown, Ohio.

SNAP FLASK BOTTOM PLATES—See PLATES (Bottom Snap Flask)

SNAP FLASK TRIMMINGS

Adams Co., The,
175 Foster St., Dubuque, Iowa.

SNAP FLASKS—See FLASKS

SOAPSTONE

Hill & Griffith Co., Cincinnati, Ohio.

SOAPSTONE (Red and Yellow)

Paxson, J. W., Co.,
Nicetown Lane and D St., Philadelphia, Pa.

SPIEGELEISEN

Bethlehem Steel Co., Bethlehem, Pa.
New Jersey Zinc Co.,
160 Front St., New York City.

SPRAY GUNS

Malleable Iron Fittings Co., Branford, Conn.

SPRUES (Spring)

Malleable Iron Fittings Co., Branford, Conn.

SPRUE CUTTERS

Foundry Equipment Co.,
1831 Columbus Rd., Cleveland, O.

SQUEEZERS (Hand and Power)

Adams Co., The,
175 Foster St., Dubuque, Iowa.
Arcade Mfg. Co., Dept. D, Freeport, Ill.
Berkshire Mfg. Co.,
Whitney Power Block, Cleveland, Ohio.
Moline Iron Works, Moline, Ill.

CAPE MAY SAND

There is no better way of judging what *Cape May Sands* will do, than by what they *have* done.

It is a fact that hundreds of highly successful foundrymen have been using *Cape May Sands* for years

May we send YOU samples?

We can furnish you an unlimited supply of undried or kiln dry grades of Sandblast sands in five grades—Nos. 0, 1, 2, 3 and 4. Double screened to insure uniform size. Order direct or through our dealers.

Railroad connections on both Pennsylvania R. R., and Philadelphia and Reading.

Cape May Sand Company
512 Washington Street
Cape May, N. J.

PORTAGE SANDS
MOLDING OVER 98% SILICA SANDBLASTING
THE PORTAGE SILICA CO., YOUNGSTOWN, OHIO.

JONES SAND COMPANY
Molding Sands for Aluminum, Brass, Iron and Steel Castings
277 East Long Street
COLUMBUS, OHIO

SAND
Ohio Red, Gallia Red, Sandusky, Nickel Plate, Glass, Blast, Silica, Core, Fire, Bank, Canadian, Lake
Molding Sand for Light and Heavy Casting
STOVE PLATE and BRASS

The Keener Sand & Clay Company
Dealer and Producer of All Grades of
Sand and Fire Clay
Fire Brick of any Desired Shape
514 Hartman Building
COLUMBUS OHIO

Whitehead's Foundry Sands

are laboratory controlled and foundry tested

We are amply equipped and prepared to furnish the proper sand for any variety of casting, having unexcelled resources and facilities. We are producers and shippers of Albany and North River Molding Sand, New Jersey Molding Sand, Lumberton Sand, Millville Gravel, Cattarugus Molding Sand, Windsor Lock Molding Sand, Strong and Sharp Silica Steel Molding Sand, Furnace Bottom Sand, Screened Jersey Fire Sand, Jersey Fire Clay, Kaolin and Cupola Daub, Core Sands and Blast Sands. Importers of French Sand.

We also carry in our various warehouses a complete line of foundry supplies.

WHITEHEAD BROTHERS COMPANY
Providence NEW YORK Buffalo
FOUNDRY SANDS, SUPPLIES AND EQUIPMENT

SQUEEZERS (Power)
Arcade Mfg. Co., Dept. D, Freeport, Ill.
Berkshire Mfg. Co.,
Whitney Power Block, Cleveland, Ohio.
Federal Malleable Co., West Allis, Wis.

STARS
Cleveland Nickel Works,
1147 W. 67th St., Cleveland, O.

STARS (Tumbling Mill)
Paxson, J. W., Co.,
Nicetown Lane and D St., Philadelphia, Pa.

STEEL
Bethlehem Steel Co., Bethlehem, Pa.

STEEL (High Speed)
Bethlehem Steel Co., Bethlehem, Pa.

STEEL BANDS
Adams Co., The,
175 Foster St., Dubuque, Iowa.

STEEL SASH
Truscon Steel Co., Youngstown, O.

STEEL (Shot)
Globe Steel Abrasive Co., The,
Dept. F., Mansfield, O.
Pangborn Corp.,
P. O. Box 851, Hagerstown, Md.

STEEL (Structural)
Bethlehem Steel Co., Bethlehem, Pa.
Penn Foundry & Mfg. Co., Reading, Pa.

STEEL SHOT
Pittsburgh Crushed Steel Co.,
61st and A. V. Ry., Pittsburgh, Pa.

STOKERS (Mechanical)
American Engineering Co.,
Cumberland and Aramingo Sts.,
Philadelphia, Pa.

STONE (Oil)
Carborundum Co., Niagara Falls, N. Y.

STOPPERS
Ross-Tacony Crucible Co.,
Tacony, Philadelphia, Pa.

STOVE SPECIALTIES (Tin)
United States Chaplet & Supply Co.,
140 Cedar St., New York City.

SULPHURIC ACID
New Jersey Zinc Co.,
160 Front St., New York City.

SWAB GUNS (Pneumatic)
Macleod Co.,
2225 Bogen St., Cincinnati, O.

SWABS (Blacking, Pneumatic)
Macleod Co.,
2225 Bogen St., Cincinnati, O.

SWABS (Flax)
Paxson, J. W., Co.,
Nicetown Lane and D St., Philadelphia, Pa.

SYSTEMS (Business)
Ernst & Ernst, 27 Cedar St.,
New York City.

TALC
Pettinos, George F.,
1206 Locust St., Philadelphia, Pa.
Stevens, Frederic B., Inc.,
Third and Larned Sts., Detroit, Mich.

TAX SERVICE
Ernst & Ernst, 27 Cedar St.,
New York City.

TITANIUM
Titanium Alloy Mfg. Co.,
Niagara Falls, N. Y.

TONGS (Crucible)
Paxson, J. W., Co.,
Nicetown Lane and D St., Philadelphia, Pa.
Whiting Corporation, Harvey, Ill.

TOOLS (Electric)
Independent Pneumatic Tool Co.,
600 W. Jackson Blvd., Chicago, Ill.

TOOLS (Pneumatic)
Cleveland Pneumatic Tool Co.,
3734 E. 78th St., Cleveland, O.
Independent Pneumatic Tool Co.,
600 W. Jackson Blvd., Chicago, Ill.
Ingersoll-Rand Co.,
11 Broadway, New York City.

TORCHES (Compressed air and Hand Pump Type)
Macleod Co.,
2225 Bogen St., Cincinnati, O.

TORCHES AND BURNERS (Oxy Acetylene)
Macleod Co.,
2225 Bogen St., Cincinnati, O.
Oxweld Acetylene Co.,
646 Frelinghuysen Ave., Newark, N. J.

TRACKING (Overhead)
Bethlehem Steel Co., Bethlehem, Pa.
Randall Tramrail Co.,
333 N. Second St., Philadelphia, Pa.

TRAMRAIL SYSTEMS
Armington Engineering Co., The, Euclid, O.
Cleveland Crane & Engineering Co.,
Wickliffe, Ohio.
Randall Tramrail Co.,
333 N. Second St., Philadelphia, Pa.
Whiting Corporation, Harvey, Ill.

TROLLEYS
Armington Engineering Co., The, Euclid, O.
Cleveland Crane & Engineering Co.,
Wickliffe, Ohio.
Whiting Corporation, Harvey, Ill.

TRUCKS (Annealing Oven)
American Foundry Equipment Co.,
366 Madison Ave., New York City.
Elwell-Parker Electric Co., The,
4204 St. Clair Ave., Cleveland, O.
Whiting Corporation, Harvey, Ill.

TRUCKS (Electric)
Elwell-Parker Electric Co., The,
4204 St. Clair Ave., Cleveland, O.

TRUCKS (Foundry)
Chase Foundry & Mfg. Co., The,
Columbus, O.
Pangborn Corporation,
P. O. Box 851, Hagerstown, Md.
Whiting Corporation, Harvey, Ill.

TRUCKS (Industrial)
Penn Foundry & Mfg. Co., Reading, Pa.
Sterling Wheelbarrow Co., Milwaukee, Wis.
Whiting Corp., Harvey, Ill.

TRUCKS (Welders)
Oxweld Acetylene Co.,
646 Frelinghuysen Ave., Newark, N. J.

TRUSSES (Steel)
Truscon Steel Co., Youngstown, Ohio.

TUMBLING BARRELS
Henderson Bros. Co.,
135 South Leonard St., Waterbury, Conn.
Koven, L. O., & Brother, Inc.,
154 Ogden Ave., Jersey City, N. J.
Macleod Co.,
2225 Bogen St., Cincinnati, O.
New Haven Sand Blast Co.,
6 Church St., New Haven, Conn.
Pangborn Corporation,
P. O. Box 851, Hagerstown, Md.
Paxson, J. W., Co.,
Nicetown Lane and D St., Philadelphia, Pa.
Royersford Foundry & Machine Co.,
Royersford, Pa.
Scully-Jones & Co.,
2012 W. 13th St., Chicago, Ill.
Sly, W. W., Mfg. Co.,
4702 Train Ave., Cleveland, O.
Standard Radial Blast Corp.,
519-30 Church St., New York City.
Tilghman-Brooksbank Sand Blast Co.,
1122 So. 11th St., Philadelphia, Pa.
Whiting Corporation, Harvey, Ill.

TUMBLING MILLS
Cleveland Nickel Works,
1147 W. 67th St., Cleveland, O.

TURBO BLOWERS—See BLOWERS

TURNTABLES
Chase Foundry & Mfg. Co., The,
Columbus, O.
Whiting Corporation, Harvey, Ill.

URANIUM
Standard Alloys Co.,
Flannery Bldg., Pittsburgh, Pa.

VACUUM CLEANING SYSTEMS
Sturtevant, B. F., Co.,
Hyde Park, Boston, Mass.

VALVES
Westinghouse Traction Brake Co.,
Wilmerding, Pa.

VALVES (Back Pressure)
Oxweld Acetylene Co.,
646 Frelinghuysen Ave., Newark, N. J.

VALVES (Blow-Off and Cut-Off)
Berkshire Mfg. Co.,
Whitney Power Block, Cleveland, O.

VALVES (Foot and Knee)
Malleable Iron Fittings Co., Branford, Conn.

VALVES (Pneumatic)
Cleveland Pneumatic Tool Co., The,
3734 E. 78th St., Cleveland, O.

VENTILATING ENGINEERS
Pangborn Corporation,
P. O. Box 851, Hagerstown, Md.
Sturtevant, B. F., Co.,
Hyde Park, Boston, Mass.

VENTILATING SYSTEMS
Pangborn Corporation,
P. O. Box 851, Hagerstown, Md.
Skinner Bros. Mfg. Co., Inc.,
1474 S. Vandeventer Ave., St. Louis, Mo.

VENTILATORS
Skinner Bros. Mfg. Co., Inc.,
1474 S. Vendeventer Ave., St. Louis, Mo.
Sturtevant, B. F., Co.,
Hyde Park, Boston, Mass.
Swartwout Co.,
18511 Euclid Ave., Cleveland, O.

VIBRATORS
Adams Co., The,
175 Foster St., Dubuque, Iowa.
Arcade Mfg. Co., Dept. D, Freeport, Ill.
Berkshire Mfg. Co.,
Whitney Power Block, Cleveland, O.
Malleable Iron Fittings Co., Branford, Conn.

VIBRATORS (Electric)
Foundry Supplies & Mfg. Co.,
2221 Orchard St., Chicago, Ill.

WAX (Vent, Core, Wire, Pattern)
United Compound Co.,
228 Elk St., Buffalo, N. Y.

WEDGES (Foundry)
Sterling Wheelbarrow Co., Milwaukee, Wis.

WELDING & CUTTING APPARATUS & EQUIPMENT (Electric)
Wilson Welder & Metals Co.,
Wilson Bldg., Hoboken Factory Terminal,
Hoboken, N. J.

WELDING AND CUTTING APPARATUS AND SUPPLIES (Oxy Acetylene)
Imperial Brass Mfg. Co.,
1200 W. Harrington St., Chicago, Ill.
MacLeod Co.,
2225 Bogen St., Cincinnati, O.
Oxweld Acetylene Co.,
646 Frelinghuysen Ave., Newark, N. J.

WELDING AND CUTTING EQUIPMENT (Electric Arc)
Wilson Welder & Metals Co.,
Wilson Bldg., Hoboken Factory Terminal,
Hoboken, N. J.

WELDING FLUXES
Chemical Treatment Co.,
81 New St., New York City.

WELDING RODS AND WIRE
Oxweld Acetylene Co.,
646 Frelinghuysen Ave., Newark, N. J.
Wilson Welder & Metals Co.,
Wilson Bldg., Hoboken Factory Terminal,
Hoboken, N. J.

WHEELBARROWS
Sterling Wheelbarrow Co., Milwaukee, Wis.

WHEELS (Grinding) — See ABRASIVE WHEELS

WINDOWS (Rolled or Pivoted Steel)
Truscon Steel Co., Youngstown, O.

WIRE BRUSHES—See BRUSHES (Wire)

WIRE (Welding)—See WELDING RODS AND WIRE

WOOD WORKING MACHINERY
Oliver Machinery Co., Grand Rapids, Mich.

ZINC
New Jersey Zinc Co.,
160 Front St., New York City.

ZINC (Boronic)
American Boron Products Co., Inc.,
Reading, Pa.

ZINC DUST
New Jersey Zinc Co.,
160 Front St., New York City.

ZINC OXIDE
New Jersey Zinc Co.,
160 Front St., New York City.

ZINC STRIPS AND PLATES
New Jersey Zinc Co.,
160 Front St., New York City.

Ask us why

25% stronger desugared

CORE-MOL
A MOLASSES BINDER

DON'T WAIT

UNTIL A CASTING BREAKS
TO TALK CORE-BINDERS

PLAY SAFE

AVOID INCONVENIENCE

WRITE AT ONCE AND ORDER
ONE BARREL OF CORE-MOL

SAFETY—EFFICIENCY—ECONOMY

NO SULPHUR
NO FERMENTATION
GREATER TENSILE STRENGTH

MIFFLIN CHEMICAL
CORPORATION
Philadelphia, Pa.

New York Warehouse
527 Hudson Street

USE

BORNE SCRYMSER COMPANY
COROYL
NEW YORK

Dixon's Graphite Facings

—for Clean Castings

Dixon's Facings are easily applied—and they form the necessary separation between the molten metal and the sand to insure clean lifts. *Much time and expense is saved in cleaning and machining.*

There is a grade which is particularly adapted for your class of work. May we send you a sample? *Write Dept. 51-S.*

Made in Jersey City, N. J. by the

Joseph Dixon Crucible Company

Dept. 51-S
Established 1827

THE ANSWER
TO THE FOLLOWING QUESTIONS
IS YES.

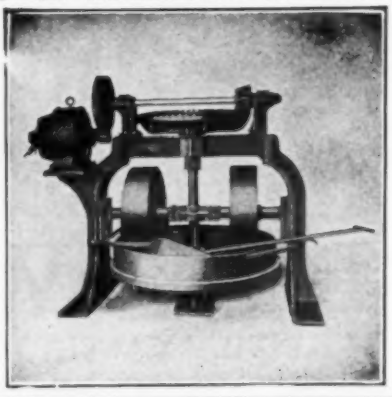
1. Will it slick under hand or tool?
2. Does it peel castings smooth and clean?
3. Does it give the castings that beautiful grey color?
4. Does it run uniform, one shipment with another?
5. Is it more economical than cheaper brands?

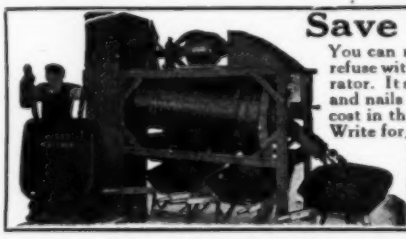
Providing it's

USG

MEXICAN PLUMBAGO
Manufactured by
THE UNITED STATES GRAPHITE CO.
SAGINAW, MICHIGAN
Mines in Sonora, Mexico

PHILLIPS & McLAREN CO.
We manufacture
Grinding Pans
of all types and sizes for Steel, Gray Iron and Malleable Foundries.
24th and Smallman Sts., Pittsburgh, Pa.





Save Your Iron!
You can reclaim 25% of your foundry refuse with a High Duty Magnetic Separator. It separates iron, coke, wire, rods and nails to be used again. Earns its cost in three months by many savings. Write for *free* booklet on magnetic separation in foundries—learn how you can make a fortune from your foundry dump. Write
Magnetic Manufacturing Co.
277 23rd Ave., Milwaukee, Wis

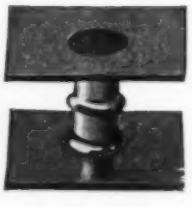
FRANKLIN GAGGERS
PATENTED DEC. 13, 1910 - Nº 978782
Four times the grip of ordinary gaggers
MADE OF SQUARE TWISTED STEEL
SIZES: ⅛"-5/16"-⅜"-½"-⅝" READY FOR QUICK SHIPMENT.
FRANKLIN CORE ROD & GAGGER CO., Franklin, Penna.

BUFFALO BRAND VENT WAX
is being used in some foundry in your locality. Why not in yours? If you want their name, ask your supply man or write us.
We are always glad to submit samples of our different grades and quote prices.
UNITED COMPOUND CO., 228 ELK ST., BUFFALO, N. Y., U. S. A.

SHRINKS and CRACKS ELIMINATED
BY USING
CHILL MOLDOCHIL NAILS
THE FOWLER & UNION HORSE NAIL CO.
BUFFALO, NEW YORK

Philadelphia Chaplets

Chaplets are not a side line with us. We specialize in the production of Chaplets. Any of our customers will tell you, that we make the Best.



Philadelphia Chaplet & Mfg. Co.
School Lane & P. & R. Ry., Wissahickon
Philadelphia, Pa.

Chaplets

All types and sizes
Including a complete line of HINGE TUBES for making holes in castings instead of drilling; CATCHES, DOVE TAILS and other sheet metal forms made to save expensive machining of castings.
Chaplet problems solved, all requirements supplied.
Quality, service and prices very desirable.
Full particulars and free samples sent upon request. Investigate! Write!
United States Chaplet & Supply Co.
140 Cedar St. NEW YORK CITY

Stop Leg and Foot Burns In *Your* Foundry

They not only cause much suffering but are costly to employer and employee alike.

"Adjustal" Leggins Prevent Leg and Foot Burns.

Made in Several Styles and Materials.

We also make Asbestos Gloves and Mittens.

SEND FOR OUR CATALOG OF SAFETY EQUIPMENT

THE SAFETY EQUIPMENT SERVICE CO.

Buell. W. Nutt, President

1228 St. Clair Ave., N. E., CLEVELAND, O. *

The Motor is directly under the Riddle, fully enclosed, dust and dirt proof. No power is wasted. No gears to wear out.

Some Speed!

One ton of moist sand can be sifted in four minutes, by the use of the

SANDHOG

A special rotary eccentric motor-housing accounts for its great capacity. Only *the screen is vibrated.* No sand sifter but the "*SANDHOG*" has this feature.

The "*SANDHOG*" is portable, easily handled, very durable—and takes but little power for operation. It accommodates any Standard Riddle up to 20" in diameter.

To fully understand the surpassing merits of the "*SANDHOG*" you must try it in actual service. *May we arrange for a 30 days' trial?*

VIBRATING MACHINERY CO.

Incorporated

546 West Jackson Boulevard, CHICAGO

No. 1 Vibrator
(HALF SIZE)

MATCH PLATE

PATENTED

USE THE RED ELECTRIC VIBRATOR

AND INCREASE PRODUCTION

No. 1	VIBRATOR	$10.00	Wt. 1⅛	lbs.	for Light	Match Plate
No. 2	"	$13.00	" 2⅞	"	" Medium	" "
No. 4	"	$17.00	" 4½	"	" Heavy	" "
No. 8	"	$21.00	" 7¾	"	" Machine	

Nos. 4 and 8 Vibrators are used on benches and tubs.
(No cable is furnished with No. 8)

KNEE SWITCH, $3.00

Give accurate voltage and cycle when ordering.

Order from your supply house TODAY

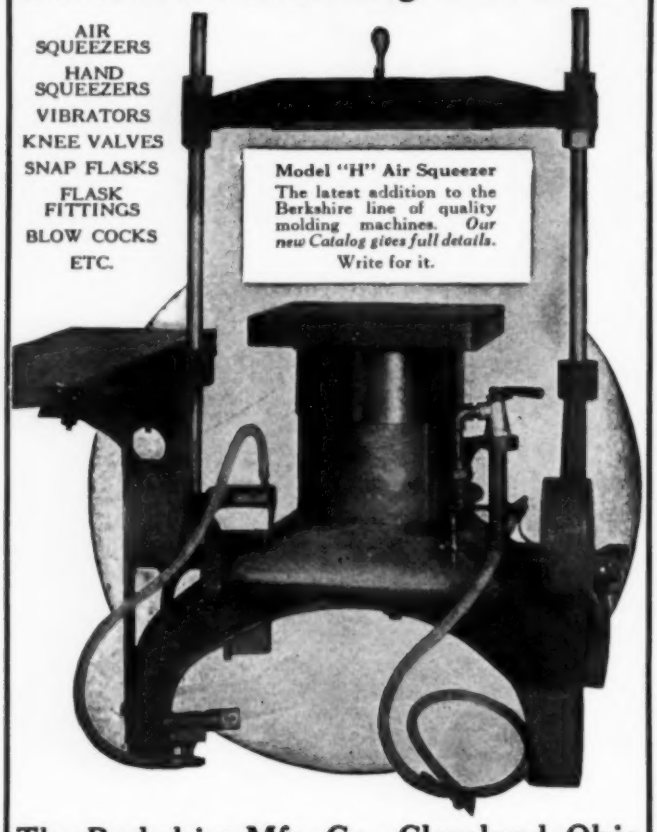
MANUFACTURED BY

Foundry Supplies Mfg. Co.

2221 Orchard St. CHICAGO, ILL.

Berkshire Molding Machines

AIR SQUEEZERS
HAND SQUEEZERS
VIBRATORS
KNEE VALVES
SNAP FLASKS
FLASK FITTINGS
BLOW COCKS
ETC.



Model "H" Air Squeezer
The latest addition to the Berkshire line of quality molding machines. *Our new Catalog gives full details.*
Write for it.

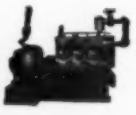
The Berkshire Mfg. Co., Cleveland, Ohio

PENNSYLVANIA

Pennsylvania Double Suction—Single Stage Centrifugal Pumps are thoroughly explained in Bulletin Number 202.

PENNSYLVANIA PUMP & COMPRESSOR CO.
Main Office and Works: Easton, Pa.

Westinghouse Traction Brake Co.



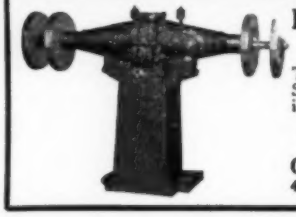
Industrial Air Compressors in all types and sizes

General Offices and Works:
WILMERDING, PA.

MUMFORD MOLDING MACHINES

INCREASE PRODUCTION
SIMPLE, RUGGED CONSTRUCTION
EASY TO OPERATE

HANNA ENGINEERING WORKS
1759 ELSTON AVE., CHICAGO, ILL.



Heavy Duty Grinders, Buffers and Polishers

Timken adjustable bearings 25 years wear, Safety and production features, not found in others.

All sizes, 1/4 HP up. Send for catalog.

CLEVELAND ARMATURE WORKS, Inc.
4732 St. Clair Ave. Cleveland, O.

Save Labor and Floor Space
with a
Rathbone Multiple Molding Machine

Increase Your Efficiency
with
The GRIMES JAR RAMMED ROLL OVER MOLDING MACHINE

GRIMES MOLDING MACHINE CO.

5736 HASTINGS STREET
DETROIT MICH.

DAVENPORT

JOLT-ROLLOVERS—JOLT STRIPPERS—PLAIN JOLTS
JOLT SQUEEZERS—PLAIN AIR SQUEEZERS

See Full Page Ad in First of Month Edition

DAVENPORT MACHINE & FOUNDRY CO.
DAVENPORT, IOWA

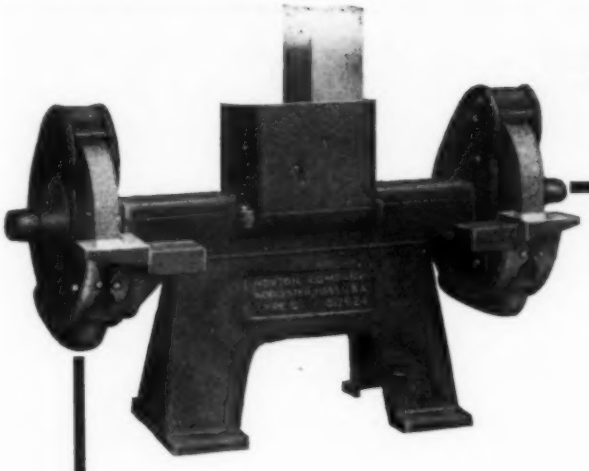
Thor PORTABLE GRINDERS

Be sure to write for full details.

These machines are of the reciprocating piston type, having four pistons direct acting on the crank shaft. CORLISS Valves with short and equal air travel for all cylinders, and large air chamber between cylinders insure an even, smooth-running machine with *great power and speed.* The air chamber has a *release valve* which opens automatically when throttle is closed, relieving the vacuum and allowing the wheel to stop gradually and without jerk.

Equipped with Pressed Vanadium Steel Pistons and Connecting Rods. Pressed steel is also used in the spindle support and wheel guard, and a combination of pressed steel and bar stock in the throttle. These features account for the *extreme lightness* with even greater durability than with materials generally used.

INDEPENDENT PNEUMATIC TOOL COMPANY
600 W. Jackson Blvd., CHICAGO, ILL.
New York Cleveland Pittsburgh Detroit Birmingham Philadelphia
San Francisco St. Louis Montreal Toronto Boston



A Heavy, Rigid Floor Stand for Foundry Grinding

The NORTON floor stand was developed for general machine shop and foundry work. It is heavy and rigid and properly designed —that means economy.

The floor stands are furnished in four sizes carrying wheels 14", 16", 20" and 24".

NORTON bench stands are furnished in sizes for wheels ranging from 6 to 14 inches.

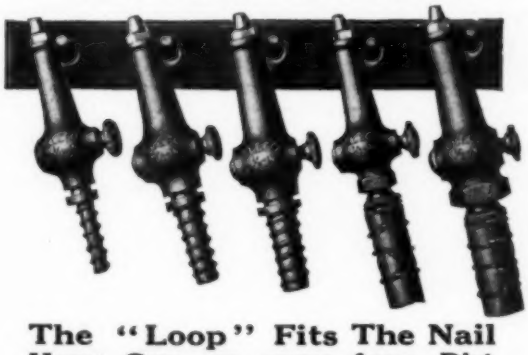
NORTON COMPANY, Worcester, Mass.

NEW YORK CHICAGO DETROIT PHILADELPHIA

Norton Company of Canada, Limited
Hamilton, Ontario

W-13

Hang-'em-up
Cleco BLOW GUNS
"A FOUNDRY NECESSITY"



The "Loop" Fits The Nail
Hang Gun up away from Dirt
Made in Sizes, ¼", ⅜", ½", Pipe Thread or Hose Stem Inlets —⅛" Diameter-Outlets

Curved Extension Tubes for Use with Hang-'em-up Guns. Furnished in two lengths 6" and 12".

The standard Nozzle-Tip can be removed and the Curved-Extension used to reach into any Pocket or Corner that cannot be reached with the Standard Gun.

Write for Bulletin No. 55

THE CLEVELAND PNEUMATIC TOOL CO.
CLEVELAND, OHIO, U. S. A.

SERVICE Strand TRADE MARK EFFICIENCY

ORIGINATORS MANUFACTURERS

TYPE M 8 2 H.P. MOTOR
GRINDING WHEEL CAPACITY 10x1¼

Eighteen years of steady growth demonstrates the high-class reputation of "Strand" flexible shaft grinders, in the industrial field.

We make them in several types and sizes Motor and Belt Drive

MANUFACTURED BY

N. A. STRAND & CO., 5001 No. Lincoln St., Chicago

20 Bags of GLOBE CORNERED STEEL GRIT equal a whole carload of Sand—

because this cleaning abrasive does not pulverize and can be used over and over again—from 250 to 275 times.

Globe Cornered Steel Grit cleans faster and better than sand—furthermore, it leaves an absolutely clean metallic surface.

Globe Cornered Steel Grit eliminates dust—gives a decent working condition for workers—reduces ventilation requirements.

Globe Cornered Steel Grit saves much handling and hauling, and it requires no driers or large storage bins like sand.

There is a size for every class of cleaning. *May we send samples?*

Grit-blast your Castings and SAVE MONEY

The Globe Steel Abrasive Co.
Dept. F. MANSFIELD, OHIO, U. S. A.

Superior Steel Exhaust Tumbling Mills, Dust Arresters, Cinder Mills and White Hard Iron Stars

SUPERIOR

Superior Exhaust Tumbling Mills, durable and reliable.

Universally used by all Foundries.

Pitch on gears and pinions 2¼" easily meshed.

Every part interchangeable.

Round and square mills to meet every condition.

Independent trunions with Babbited Bearings.

Only highest grade materials and workmanship.

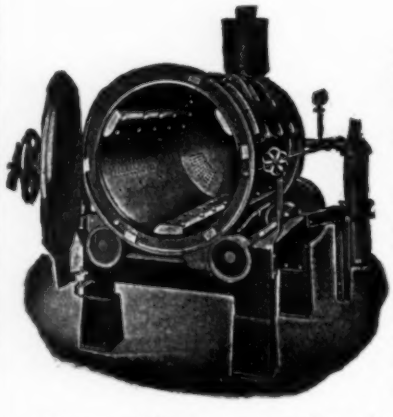
Reduction in cleaning costs with our mills.

THE GLASSFORD DUST ARRESTER will handle your dust problems

WRITE FOR CATALOGUE

CLEVELAND NICKEL WORKS
Established 1891
Cleveland, Ohio

Standard "Radial Blast" Sand Blast Barrels



In the past four years, the orders for repair parts have been on rolls and pinions.

We are now making the rolls of 12% manganese steel and the pinions of steel.

We are NOT in the repair part business, only as a convenience to our customers.

Our pride is to make the best sand blast barrels possible, with the lightest upkeep.

Four sizes: 24", 36", 48" and 60" diam.

Ask us about them.

Standard Radial Blast Corporation
30 Church St. New York.

100% results—satisfaction guaranteed
HENDERSON TUMBLING BARRELS
May we send you complete details?
THE HENDERSON BROTHERS CO.
Waterbury, Conn, U.S.A.

HARRISON SUPPLY CO. FOR SAND BLASTING IRON, STEEL BRASS ANY KIND OF METAL SHOT GRIT

PERFECT
METALLIC ABRASIVES
Chilled Shot - Diamond Grit
FOR DROP FORGINGS
Send for Samples
HARRISON SUPPLY COMPANY
Boston - Mass.

SAMSON

STEEL SHOT

STEEL SHOT & GRIT COMPANY SAMSON STEEL SHOT

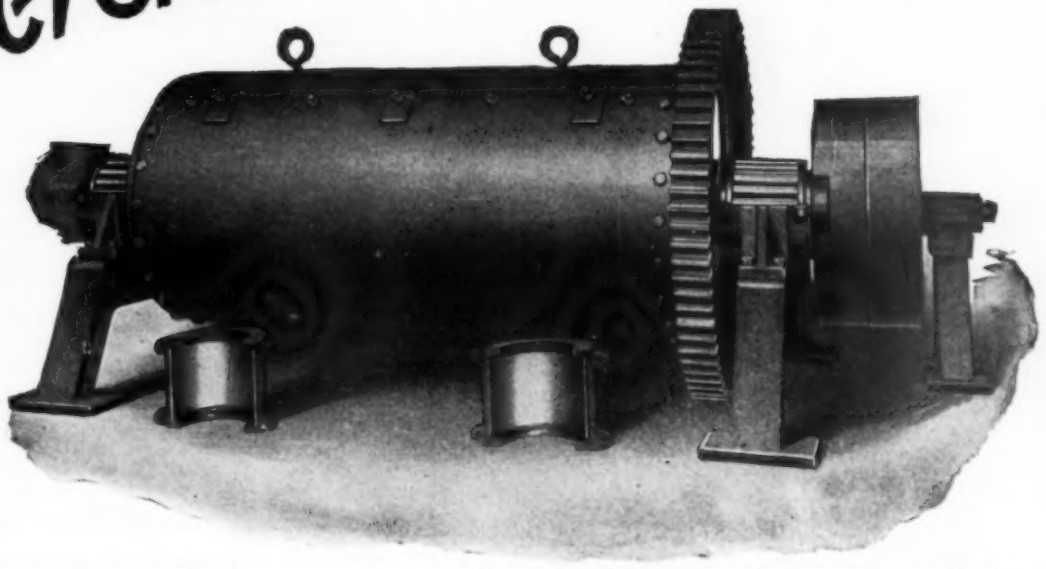
and DIAMOND STEEL GRIT

The Scientific Metal Blasting Abrasives for *all Blast Cleaning operations.* One ton outlasts a carload of sand. They reduce costs, clean better and with less dust.

Sole Manufacturers
STEEL SHOT & GRIT CO., Inc.
61st and A. V. Ry. Pittsburgh, Pa.
(Plants at Pittsburgh, Pa. and Amesburg, Mass.)

The Royersford

"The Lightest Running Tumbling Mill Made"



Royersford Roller Bearing Exhaust Tumbling Mills have solid steel rollers which are held firmly in cages of forged steel—and are absolutely dust proof.

We also manufacture *Roller Bearing Square Tumbling Mills* which are particularly adapted for stove plate, school furniture, and very frail work, which must be closely packed to prevent breakage.

It will pay you to write for full particulars

We are equipped to furnish our Exhaust Tumbling Mills with Babbited Bearings instead of Roller Bearings, should anyone in the foundry trade desire them.

The Royersford Foundry & Machine Co., Inc. 52 N. 5th St., Philadelphia, Pa.

Works; Royersford, Pa.

Sand Blast Equipment and Accessories

The Tilghman-Brooksbank Sand Blast Company
1122 South 11th St. Philadelphia, Pa.

READY FOR SHIPMENT—Complete Stock Sand Blast Barrel Parts for New Haven barrel and Standard cinder mills.

Write us for prices.

THE STANDARD EQUIPMENT COMPANY
NEW HAVEN CONNECTICUT

DUSTLESS SELF-CONTAINED
HOEVEL SANDBLAST
AUTOMATIC
MACHINES

Original, Efficient, Durable

Revolving Barrel Machines, Rotary Table Machines, Hose Sandblasts, Dustless Sandblast Rooms, etc. Nozzles, repairs and accessories always in stock.

L. O. KOVEN AND BROTHER, Inc.
154 Ogden Ave., Jersey City, N. J.
Cleveland Office 941 Engineers Bldg.
Successor to Hoevel Manufacturing Corporation

NEW HAVEN SAND BLAST AND FOUNDRY EQUIPMENT

Sand Blast Barrels
Sand Blast Rooms
Sand Blast Cabinets
Sand Blast Tanks
Dust Arrestors
Tumbling Barrels
Air Compressors
Air Vibrators

Send for loose leaf bulletins on above
OR
NEW CATALOGUE

THE NEW HAVEN SAND BLAST CO. NEW HAVEN, CT. CLEVELAND

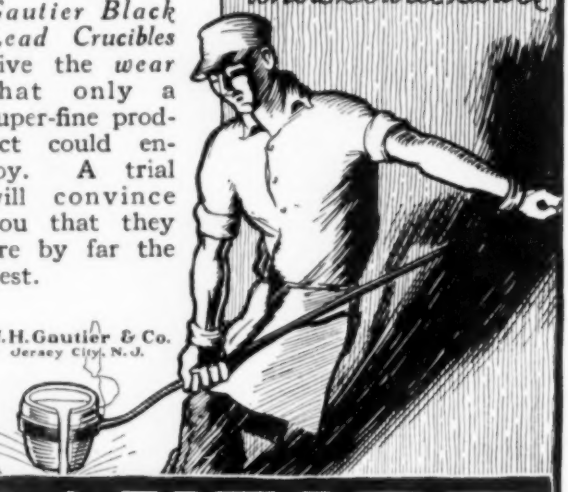
Do You Know—

that there is as much difference between material used in crucibles as there is in the wool used in clothing!

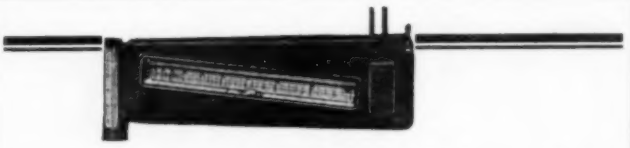
Gautier Black Lead Crucibles give the *wear* that only a super-fine product could enjoy. A trial will convince you that they are by far the best.

J. H. Gautier & Co.
Jersey City, N. J.

"Where Service Serves"



GAUTIER
Black Lead Crucibles



Saved THREE TONS of Coke a Day

This is an actual record common to Bacharach P-V Meter installations. In addition to knowing the volume of air to the cupola and obtaining uniform heat, it is possible to duplicate conditions day after day by accurate knowledge of the facts possible with this meter. Write for Bulletin 2110, with reproductions of graphic charts from actual operation.

BACHARACH INDUSTRIAL INSTRUMENT CO.
7000 Bennett St., Pittsburgh, Pa.

BACHARACH INDUSTRIAL INSTRUMENTS

HEY THERE!

Looky here boys—if you want to cut your Crucible Costs, just read wot I sed in the last issue of "THE FOUNDRY" and wot I'll have to say in the next issue!

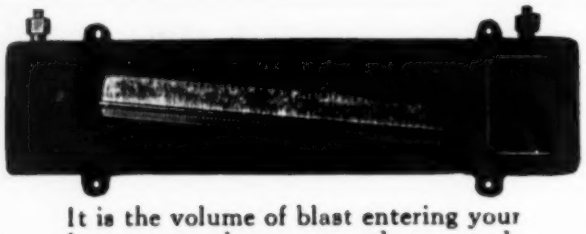
Sincerely,
"LAVA LUKE"

Lava Crucible Co. of Pittsburgh
Dept. F

ROSS-TACONY CRUCIBLES

Specify ROSS-TACONY CRUCIBLES once—and you will keep on doing it!
For the last 50 years they have been regarded as the standard of quality.

ROSS-TACONY CRUCIBLE CO.
TACONY, PHILADELPHIA, PA.



It is the volume of blast entering your furnace, not the pressure, that controls furnace operations.

The Clark Blast Meter indicates the Volume.

Booklet cheefully sent—write for it

CHAS. J. CLARK BLAST METER CO., GLADBROOK IOWA

GENERAL FURNACE CO.

1015 Chestnut St., Philadelphia, Pa.

Successor to: Electric Furnace Construction Co., Phila.
American Industrial Furnace Corp., Boston

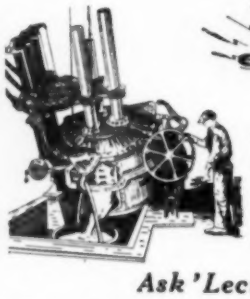
Electric Furnaces for Heat Treating, Melting or Smelting

Electric Heat Treating
AND
Annealing Furnaces
Electric Brass Melting Furnaces

—o—

THE ELECTRIC FURNACE COMPANY
Salem, Ohio

Rapid
Lectromelt
Furnaces



stand supreme for economical production of Tool Steels, Alloy Steels, Steel Castings, Gray and Malleable Iron.

Ask 'Lectromelt Users.

Pittsburgh Electric Furnace Corp.
P. O. Box 1125 Pittsburgh, Pa.
Electric Furnaces—Good Furnaces Only

Swindell Electric Melting Furnaces

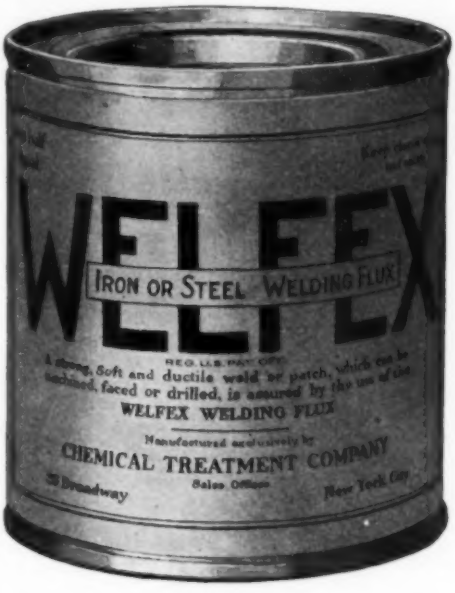
will simplify your melting problems

Made in all capacities,—ideally suited for producing steel castings, alloy steels, malleable iron, tool steels, gray iron, Steel for Forgings, etc.

WRITE FOR DESCRIPTIVE BULLETIN

William Swindell & Brothers
Pittsburgh, Penna.

For Greater Economy and Better Welding Results–



Weld
with
WELFEX
!

SAMPLE FURNISHED On Request

Chemical Treatment Company
26 Broadway New York, N. Y.

Selling and distributing agents will be appointed at all supply centers of the United States and Canada. Communications are invited from reputable concerns engaged in the sale and distribution of manufacturing and foundry supplies.

*

GRINDLE
PULVERIZED COAL EQUIPMENT

COMPLETE SYSTEMS DESIGNED AND INSTALLED
Send for Bulletin No. 6
Grindle Fuel Equipment Co., Harvey, Ill.
SUBSIDIARY OF WHITING CORPORATION (Chicago Suburb)

Imperial Welding Equipment
has a new mixing principle, accurate regulation of gases and eight torches in ONE—all exclusive features. The Imperial Acetylene Generator makes its own acetylene 2 to 4 cents cheaper per cubic foot than you can buy it.
The Imperial Brass Mfg. Co.
1203 W. Harrison St., Chicago, Ill.
Makers of Welding, Cutting, Carbon and Lead Burning Equipment and Supplies

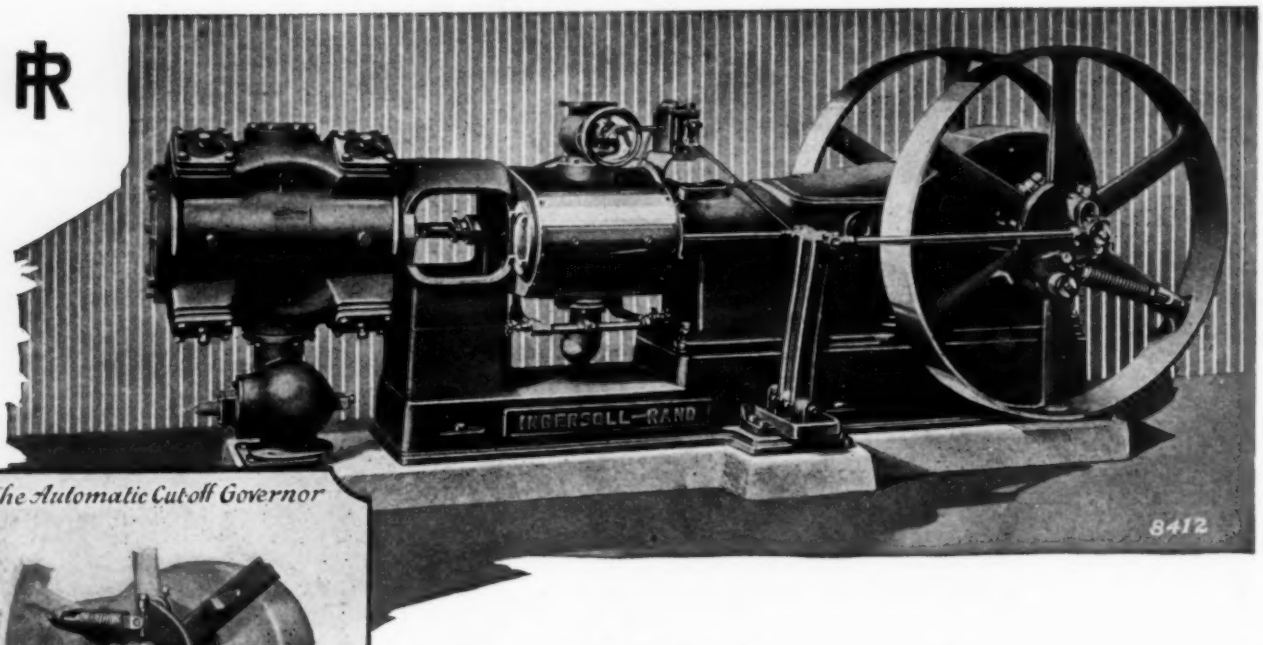
HAUCK TRADE MARK
OIL BURNERS for
Cupola lighting Mold drying
Ladle heating Core Ovens
Write us about your foundry heating problems. Our experience is at your service without obligation.
Hauck Manufacturing Company
131 Tenth St. Established 1900 Brooklyn, N. Y.

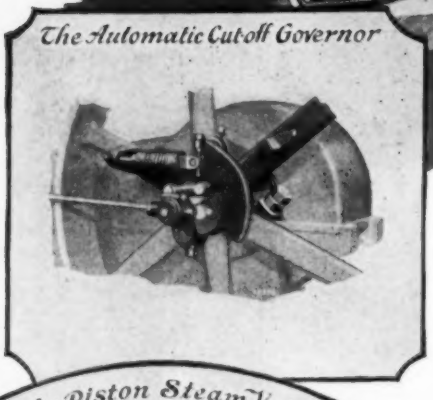
OXYGEN, ACETYLENE, HYDROGEN
for cutting, welding, etc.
Quick shipment and low prices also on cylinders, valves, torches, regulators and supplies
INTERNATIONAL OXYGEN CO., Newark, N. J.
Branch Offices: New York, Pittsburgh, Toledo

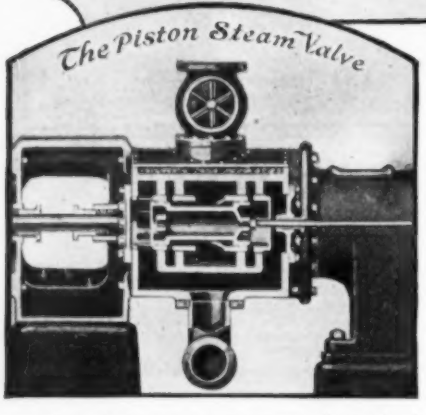
CASTINGS RECLAIMED
By Electric Welding
using
WILSON "COLOR-TIPT" WELDING WIRE

CAST IRON	*BRASS & BRONZE*	*STEEL*
Grades No. 12	Grade No. 20	Grade No. 9 and No. 17

WILSON WELDER & METALS CO., INC.
Wilson Bldg. Hoboken, N. J.







Class FR compressors are described in detail in Bulletin 3050. Send for your copy now.

The High Steam Economy of Class "FR" Air Compressors

The Cutoff Fly-wheel Governor automatically performs the following functions:

Varies the position of steam cutoff to meet any changes in air load or boiler pressure.
Maintains a constant compressor speed under all conditions. It has hand adjustment provided for adjusting the speed to anything between full and one-half rated speed.

The Balanced Piston Steam Valve is of special design for use of high steam pressure and superheat. It will not warp nor leak causing lubrication troubles and wastage of steam. The Class "FR" Piston Valve will also operate with high economy under ordinary saturated steam conditions.

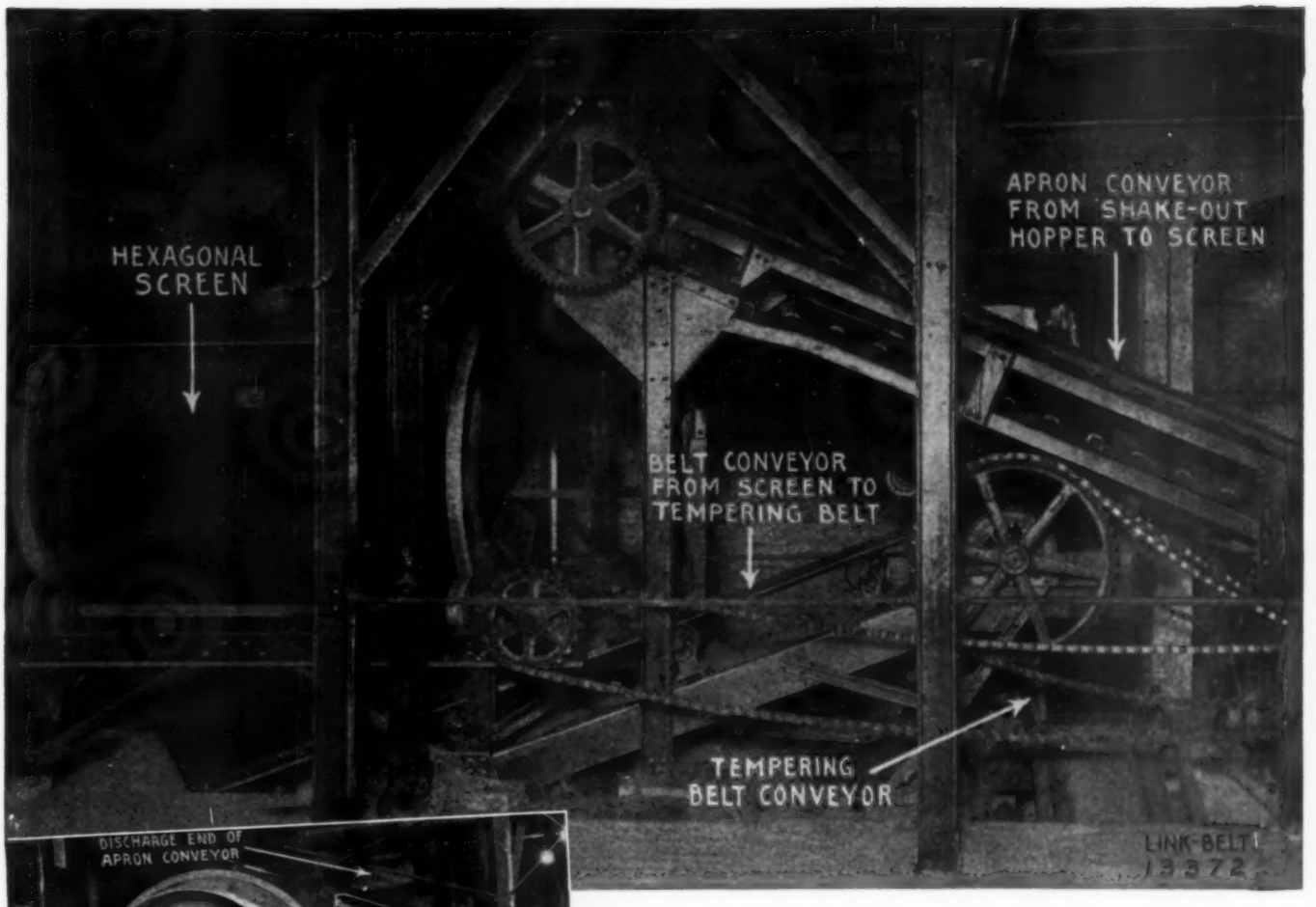
These and other features make it possible for Class "FR" compressors to operate with unusually high steam economy. In fact, a compressor equipped with ordinary flat valve and throttle governor requires approximately 50% more steam than is used with the same size "FR" machine.

INGERSOLL-RAND COMPANY, 11 BROADWAY, NEW YORK

ATLANTA
BIRMINGHAM
BOSTON
BUFFALO
BUTTE
CHICAGO
CLEVELAND
DALLAS
DETROIT
DENVER
DULUTH
EL PASO
HOUGHTON
JOPLIN
KNOXVILLE
LOS ANGELES
NEW ORLEANS
NEW YORK
PHILADELPHIA
PITTSBURGH
POTTSVILLE
SAN FRANCISCO
SALT LAKE CITY
SCRANTON
SEATTLE
ST. LOUIS
WASHINGTON

For Canada refer Canadian Ingersoll-Rand Co., Limited, 260 St. James St., Montreal

Ingersoll-Rand



Link-Belt Foundry Equipment Lowers Cost and Increases Output at this Foundry

THIS Link-Belt system for handling sand increased production from 60 to 120 molds in 8 hours — reduced the number of men employed from 24 to 14— decreased the number of flasks in use from 60 to 10.

Economies such as this—sufficient to pay the cost of installation in a surprisingly short time—are invariably obtained with the use of the Link-Belt system of Sand Preparation and Handling.

Successful systems have been designed and built by Link-Belt engineers to fit the conditions found in practically every foundry. *Your foundry* may also profit by such an installation.

Send for a copy of Book No. 690, which fully describes the Link-Belt material handling system for foundries and shows typical Link-Belt installations.

Other Link-Belt Products

Sand Preparing Machinery.	Crawler Cranes.
Mold Conveyors.	Electric Hoists.
Rapp Revivifiers.	Portable Loaders.
Elevators of all types.	Silent and Roller Chain Drives.
Locomotive Cranes.	

Send for catalog

1947

LINK-BELT COMPANY

Leading manufacturers of Elevating, Conveying and Power Transmission Machinery

PHILADELPHIA, 2045 Hunting Park Ave. CHICAGO, 300 W. Pershing Road INDIANAPOLIS, P. O. Box 346

Offices in Principal Cities

LINK-BELT

There is Nothing Just as Good as BORONIC ALLOYS

You may be told, this or that will be equally satisfactory and will reduce your losses just as good as BORONIC PRODUCTS. The fact that we have some imitators (but no competitors) is proof that our Boronized Metals and Alloys actually do what we claim.

BORONIC ALLOYS are protected by Basic Patent Rights. Anyone other than our own representatives who offer Boronized Alloys is misrepresenting his goods. We are the original and ONLY manufacturers of BORONICS, which were developed, perfected and are manufactured in our own laboratories and plant at READING, PENNA.

"Get the habit—USE BORONICS"

Be sure when specifying your material that it is made by the

American Boron Products Co., Inc.
SOLE MANUFACTURERS
Reading, Penna., U. S. A.

FOREIGN DISTRIBUTORS:
Edward Le Bas & Co., London, E. C. (3) Eng.
National Alloys Limited, London, Eng.
China & Japan Trading Co., Ltd., Tokyo, Japan
China & Japan Trading Co., Shanghai, China

ALLOYS

IT IS NOT OUR USUAL PRACTICE TO SELL ALLOYS AND WE ARE ASKED SOMETIMES OUR REASON FOR THIS.

MOST OF OUR CUSTOMERS PREFER TO BUY VIRGIN METAL AND TO DO THEIR OWN MIXING BECAUSE IT ENABLES THEM TO OBTAIN HIGH PURITY INGOT AND AFFORDS BETTER CONTROL OVER THEIR ALLOYING AND FOUNDRY OPERATIONS.

OUR HIGH PURITY METAL, IN 98-99% AND 99% PLUS FORMS, IS PARTICULARLY DESIRABLE FOR SUCH WORK, ON ACCOUNT OF ITS CONSISTENT ASSAYING, GRADING, ETC., MADE POSSIBLE ONLY BY THE RIGID SUPERVISION WHICH GOVERNS ITS PRODUCTION.

ANY INFORMATION WHICH WE ARE ABLE TO GIVE, UPON SUITABLE ALLOYS, MIXING, ETC., WE ARE ANXIOUS TO TENDER.

THE BRITISH ALUMINIUM CO., LTD.
165 Broadway New York City
597 King St. W. Toronto

MOLYBDENUM

Chromium (Pure & Ferro), Cobalt, Manganese (Pure & Low C.), Silicon (Pure), Titanium, Tungsten (Powder & Ferro), Silicon Aluminum Manganese Alloys (also with Titanium) Calcium Silicon Phosphor Copper and OTHER SPECIAL ALLOYS.

Large stocks carried in New York
Write for Stock List

deCourcy Browne, Inc.
Metallurgical Engineers
8 West 40th Street NEW YORK CITY

FOUNDRY MANGANESE CO.

Ferro Manganese 80%
Ferro Silicon 50%
Ferro Chrome
GROUND TO ALL SIZES

Works: CONSHOHOCKEN, PA.
Office: 200 Harrison Bldg. Philadelphia

FOUNDRYMEN'S HANDBOOK

THIS book contains the most complete collection of formulas, tables, weights, specifications and information relating to foundry work, ever gathered together. It is a compilation of THE FOUNDRY'S **"Data Sheets"** revised and brought up-to-date with much additional information.

Price $5.00 (25s.) Postpaid
THE PENTON PUBLISHING CO.
Book Department
Penton Bldg., W. 3rd St. & Lakeside Ave. 507 IF Cleveland, O.

HILLSIDE FLUOR SPAR MINES

General Offices
38 South Dearborn St., Chicago

Full page first of each month.

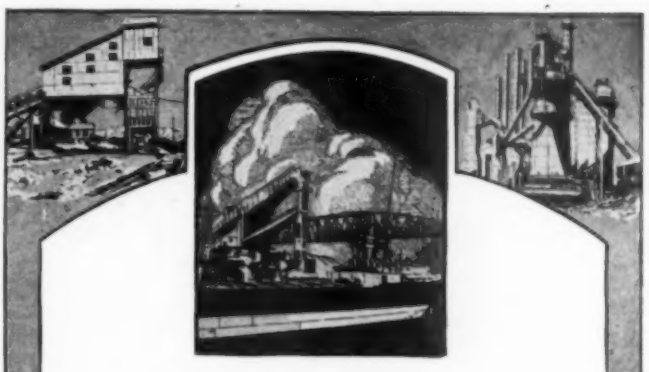
PIG IRON
COKE

FLUOR SPAR FERRO SILICON
BESSEMER FERRO SILICON
FERRO MANGANESE
FERRO PHOSPHORUS
SMITHING COAL
MOLDING SAND ALUMINUM
SPIEGELEISEN
MANGANESE, CHROME
and IRON ORES

SINCE 1880 our business has grown largely on repeat orders. This is evidence of an appreciation of honest, conscientious selling methods and of obligations fulfilled.

ROGERS, BROWN & CO.

ROGERS, BROWN & CO.
PIG IRON · COKE
CINCINNATI BUFFALO NEW YORK
CHICAGO CLEVELAND ST. LOUIS
PITTSBURGH BOSTON PHILADELPHIA



PIG IRON
IRON ORE
COAL

THE M. A. HANNA CO.
CLEVELAND
Buffalo Pittsburgh Detroit
Cincinnati Philadelphia Toronto
New York Chicago Toledo
Williamsport Baltimore

Hillman Coal & Coke Co.
STANDARD CONNELLSVILLE
LOW SULPHUR
FOUNDRY COKE
First National Bank Bldg., PITTSBURGH, PA.

PILLING & COMPANY, INC.
PIG IRON, COKE & ALLOYS
1315 Walnut St. Philadelphia
120 Broadway New York
200 Devonshire St. Boston

"Carlton" Brand
FERRO MANGANESE
C. W. LEAVITT & COMPANY
SOLE AGENTS
30 Church Street New York

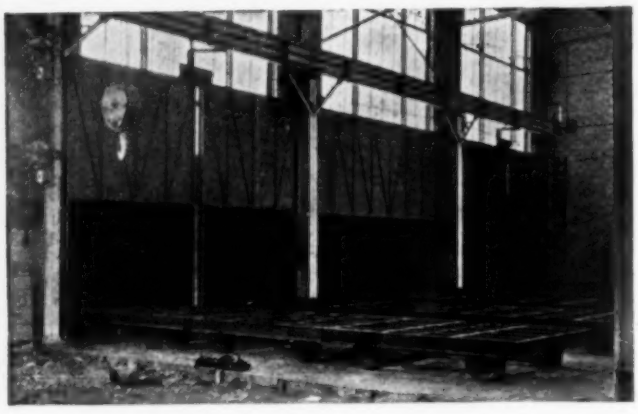
Aluminothermic Metals and Alloys
25% Ferro-Titanium; many others.
Write for pamphlet No. 2030
METAL & THERMIT CORPORATION
120 Broadway, New York
Pittsburgh Chicago Boston S. San Francisco Toronto

Ferro-Alloys and Metals

FERROSILICON—15%, 50%, 75%, 85%, 90-95%; also Refined Silicon, minimum 97% silicon
FERROCHROME—all grades from maximum 0.10% to maximum 6.0% carbon; also Chromium Metal
MANGANESE METAL, LOW CARBON FERROMANGANESE, and MANGANESE-COPPER
MISCELLANEOUS MANGANESE, SILICON, AND ZIRCONIUM ALLOYS

Our ELECTROMET BOOKLET describes our complete list of alloys and metals as well as our Service and Research Departments

ELECTROMET BRAND
Electro Metallurgical Sales Corporation
Sole Distributors
CARBIDE and CARBON BUILDING
30 East 42d Street
New York



"BUILT BY HOLCROFT & COMPANY"

has important significance to every factory executive to whose installation it applies. "Built by Holcroft & Company" means, *first*, unbiased engineering advice; *second*, correct design; *third*, carefully selected materials; *fourth*, proper brickwork and other constructive features; *fifth*, conscientious inspection; *sixth*, a guarantee insuring user-satisfaction. After that, additional engineering advice is available to those who wish it.

HOLCROFT & COMPANY

6545 Epworth Blvd. **Detroit, Mich.**

CHEMISTS PRACTICAL FOUNDRY ADVISORS

KAWIN SERVICE

BEGINS WHERE OTHERS END

We show you how to APPLY the analyses of your materials so as to REDUCE THE COST of your castings and IMPROVE THE QUALITY

Our Practical Foundrymen help eliminate losses in the foundry

CHARLES C. KAWIN COMPANY

General Offices:—431 S. Dearborn St., CHICAGO

TORONTO BUFFALO CINCINNATI SAN FRANCISCO

GABRIEL E. ROHMER, M. E. & E. M.
Consulting Engineer Metallurgist
516 5th Ave., NEW YORK
European Office—4-12 Rue d'Agueseau, Paris

Specialist in applied metallurgy of non-ferrous metals.

Application of "Rohmer Liquification Process" to molten alloys for production of sound metal and castings.

Complete design and installation of die casting plants for production of all non-ferrous metal die castings, including Copper alloys of melting points up to 2700°F.

Metallurgical reports and investigations.

Oil burners and special melting furnaces.

Babcock Testing Laboratory

Established 1913

Analytical and Consulting Chemists — Metallurgists
Mechanical Engineers

Specialists in: Iron—Steel—Alloys—Bronzes—Coal—Coke—Oils, etc.
Foundry Advisors—Physical Testing—Photomicrographs

Official and Standard Methods used exclusively

801-805 Ridge Rd., Lackawanna, N. Y. **849 Fillmore Ave., Buffalo, N. Y.**

Commercial Analytical Work Under Yearly Contract

METALLURGICAL FURNACE EQUIPMENTS

Pulverized Coal Fuel Oil Gas

FULLER ENGINEERING COMPANY

FULLERTON, PA.

American Malleable Cast Iron—*By H. A. Schwartz*

This book is the first complete treatise on "black heart" malleable iron ever published.

It covers the history of the malleable industry—its development, modern methods of manufacture, metallurgical principles involved and the properties and uses of American malleable cast iron. It also includes a detailed bibliography in which all the important books and articles published pertaining to malleable iron are listed and represents the only reference work available on the subject.

PRICE $7.00, (35s.) POSTPAID 520 I F

The Penton Publishing Co. ***Book Dept.*** **Penton Bldg., Cleveland, O.**

-for Better Cast Iron Use URANIUM

It increases STRENGTH and WEARING QUALITIES.

We will gladly send full particulars upon request.

Standard Alloys Co.
Flannery Bldg., Pittsburgh, Pa.

HARDNESS TESTING

with the SCLEROSCOPE gives you the advantage over your competitors. Our *booklet* on the Science and Testing of metals will be sent free on request.

HEAT INDICATIONS

in the foundry are now most successfully made with the Pyroscope. Inexpensive, simple, etc.

Pamphlet free

The Shore Instrument & Mfg. Co., Inc.
Van Wyck Ave. and Carll St., JAMAICA, N. Y.

Classified Advertisements

Help and Positions Wanted—For Sale and Miscellaneous

RATES

Help Wanted Advertisements
6c per word—minimum advertisement—$3.00

Position Wanted Advertisements
5c per word—minimum advertisement—$1.50

For Sale and Miscellaneous Advertisements
10c per word—minimum advertisement—$3.00

IMPORTANT

Six words must be added for box address.
Publication Dates: First and Fifteenth of the month. To insure insertion, copy must reach us ten days prior to date of publication. Please have your remittance accompany advertisement.
Help and Position Wanted advertisements should state whether—Gray Iron, Steel, Malleable or Brass.

Help Wanted

WANTED:—SUPERINTENDENT FOR brass foundry making plumbing supplies and heavy mill bearings, located within 25 miles of Chicago. Thorough experience in brass molding and core making, a good executive experienced in up-to-date methods of reducing production costs required. For consideration furnish complete record, references and salary expected. Address Box 587, THE FOUNDRY Cleveland.

WANTED:—FOREMAN WHO CAN handle both gray iron and electric steel foundry departments for Southern foundry. Must have executive ability. McLain graduate preferred. State salary and references. Address Box 617, THE FOUNDRY, Cleveland.

WANTED:—SUPERINTENDENT ABOUT 40 years old for stove, furnace and gray iron foundry employing about 175 molders. Must be able to get production. McLain graduate preferred. State salary and references. Address Box 616, THE FOUNDRY, Cleveland.

FOUNDRY FOREMAN WANTED
One who knows something about bench molding, all snap flasks, mostly light work. Cupola or Furnace, who can melt Iron from an analysis and make dependable malleable iron castings. All piece work, nine hours daily. State salary expected. Where and how long employed. Send references. Twenty to thirty molders employed. Address Box 599, THE FOUNDRY, Cleveland.

WORKING BRASS FOUNDRY FOREman for small but growing jobbing shop, located in the Ohio Valley. For the man who is not afraid of work, understands moulding and melting of metals in open flame and crucible furnaces using gas as fuel, this is an exceptional opportunity. State age, experience, references, also salary expected. Address Box 604, THE FOUNDRY, Cleveland.

FIRST CLASS CORE FOREMAN FOR steel foundry, jobbing shop. Give age, references, experience, and salary desired in first letter. Address Box 613, THE FOUNDRY, Cleveland.

WANTED:—FOUNDRY ENGINEER WHO is experienced in the design and application of equipment for producing large quantities of cored gray iron castings. Must be broadly educated man, capable of taking full charge of Engineering Department engaged in design of equipment for all foundry departments. Address Box 585, THE FOUNDRY, Cleveland.

WANTED:—STOVE PATTERN FITTER, must be experienced on new work including match plates. To a man with ability we can offer a steady position with fair compensation. Address: The Prizer-Painter Stove Works, Post Office Box 667, Reading, Penna.

WANTED: — SUPERINTENDENT FOR foundry in Detroit district, making high grade stove plate and furnace castings using match plates and loose patterns. Must be able to handle men in a manner to insure high production. In reply state salary expected, where last employed and references. Address Box 605, THE FOUNDRY, Cleveland.

SUPERINTENDENTS, EXECUTIVES, ENgineers, $3000-$25,000, will find our individual confidential service an effective, dignified medium to make desired connections. Personally conducted by MR. JACOB PENN, the eminent employment authority, known to leading business men throughout America. Not employment agency. Jacob Penn, Inc., 305 Broadway, New York.

Help Wanted

BRASS FOUNDRYMAN WANTED
If you understand the jobbing brass foundry business from A to Z, including the selling end, write us fully as to your experience, etc., and we will make you a proposition that will interest you. You cannot be too good and we will pay your price, including an opportunity to become a member of the firm. Address Box 588, THE FOUNDRY, Cleveland.

SALESMAN FOR MACHINE CASTINGS in South-eastern States. Must understand foundry practice and be able to estimate. Eventually manage foundry department of large established machinery manufacturer. Give full qualifications and past employers. P. O. Box 1517, Atlanta, Georgia.

WANTED:—AN EXPERIENCED FOUNDry Supply Salesman; one with actual foundry practice preferred; to introduce two special foundry products. Permanent position; good opportunity for future. Address Box 600, THE FOUNDRY, Cleveland.

FOREMAN FOR FOUNDRY IN ST. Louis district. Medium size gray iron foundry, capacity miscellaneous castings 5 lbs. to 5 tons. If location suits and applicant desires permanent connections, willing to prove his qualifications and ability to take full charge, write reference, age and salary in your reply. Address Box 589, THE FOUNDRY, Cleveland.

WANTED:—SUPERINTENDENT—FIRST-class man for machine equipped foundry in Ohio of 250 molder capacity, making high grade, light section, gray iron castings. Must be able to handle men in a manner to insure high production. Prefer man 30 to 40 years old, but slightly older man with good records will be considered. Professional job hunters need not apply. We want a man who has shown his worth and will pay him according to his ability. Address Box 551, THE FOUNDRY, Cleveland.

PATTERN FOREMAN FOR MALLEABLE plant making general line of malleables. One who understands estimating and can get results. Good opportunity for right man. No gray iron man need apply. In reply state age, experience and references. Temple Malleable Iron & Steel Co., Temple, Pa.

MALLEABLE FOUNDRY FOREMAN OR assistant foreman, high grade and with successful record for training molders, getting good production of quality work, and for handling men. Age between 35 and 45. Location Central West. Good references will be required. Here is a big opportunity for a man of the right qualifications. Don't waste time applying if you are only an average foundryman. Address Box 561, THE FOUNDRY, Cleveland.

SALARIED POSITIONS, $2,500 TO $25,000; executive, technical, administrative, engineering, manufacturing, professional, managing, financial, etc., all lines. If you are qualified, and receptive to tentative offers for a new connection, you are invited to communicate in strict confidence with the undersigned, who will conduct preliminary negotiations for such positions. Send name and address only; preliminary particulars will be sent confidentially, without obligating or compromising you. R. W. Bixby, Inc., 422 Lockwood Building, Buffalo, New York.

Help Wanted

SANDBLAST FOREMAN WANTED FOR plant on Pacific Coast. Must be experienced and thoroughly familiar with blasting sanitary ware. Reply, giving full detail of experience and recommendations. Fare paid. Address Box 546, THE FOUNDRY, Cleveland.

WANTED:—A FIRST CLASS PATTERN maker to take a steady position in a progressive New England plant. Address Box 572, THE FOUNDRY, Cleveland.

FIRST CLASS ACID OPEN HEARTH melter. Give age, references, experience and salary desired in first letter. Address Box 614, THE FOUNDRY, Cleveland.

WANT CLEANING AND SHIPPING Foreman for steel foundry in middlewest. Must be producer and get results. Address Box 580, THE FOUNDRY, Cleveland.

MANUFACTURING EXECUTIVES OF all kinds wanted. We are prepared to assist foundry executives and other qualified men to secure the connections they desire. The National Business Bourse, Inc., Confidential Negotiators, Association Bldg., Chicago.

Positions Wanted

A YOUNG FIRST CLASS PRACTICAL Foundryman wants a position. Finished molder and student mechanical engineer; desires to locate new connection as Foreman or Asst. Supt. Can produce successful castings from stove plate up to six and seven tons. Jobbing and machinery. In gray and high test irons. Fifteen years practical experience. Inquiries solicited. Address Box 535, THE FOUNDRY, Cleveland.

FOUNDRY ENGINEER:—BROAD EXperience in plant design, construction, maintenance and in production, now employed, desires change of location. Ideal man for large corporation. Address Box 448, THE FOUNDRY, Cleveland.

SUPERINTENDENT OR FOREMAN OF gray iron foundry, twenty years experience, light and heavy work. Mix iron by analysis. McLain graduate. Understand foundry thoroughly, both jobbing and production work. Address Box 582, THE FOUNDRY, Cleveland.

MALLEABLE EXECUTIVE WANTS JOB with broader authority running plant. At present producing such results as: highest quality "Certified Malleable"; reduction of costs; service to customers and co-operation between departments. Technical training with fifteen years practical experience in malleable. Address Box 590, THE FOUNDRY, Cleveland.

WANTED BY A FIRST CLASS FOUNDryman—Position as foundry foreman. One with 28 years experience on all classes of work; 15 years as foundry foreman and superintendent; 13 years as practical molder on all kinds of miscellaneous work, including electrical hoisting engine, elevator machinery and pumps of all description. Age 42. Can furnish the best of references. Address Box 601, THE FOUNDRY, Cleveland.

Positions Wanted

ELECTRIC FURNACE SUPERINTENDENT soon available for position; 10 years basic and acid melting. Chemical and metallurgical training; ingot and castings practice. New installation preferred. Address Box 532, THE FOUNDRY, Cleveland.

MANAGER:—IRON, STEEL, BRASS foundry. Now employed, wants to get in touch, modern foundry establishment. Any size castings; can control sulphur in basic electric steel. Address Box 602, THE FOUNDRY, Cleveland.

ACCOUNTANT, GRAY IRON FOUNDRY, expert on costs and general accounting, desires position. Can install and run system. Will save you accounting fees. Address Box 595, THE FOUNDRY, Cleveland.

A THOROUGH, PRACTICAL FOUNDRY superintendent is open for position in gray iron; 15 years experience as foreman and superintendent; 30 years in foundry in medium and heavy work; in green, dry sand and loam molding; handle any class of work; read blue print; can estimate and figure weight and cost of castings. Mix by analysis; would like to get in touch with reliable firms who are willing to show their appreciation for results obtained. Can take complete charge of foundry. Address Box 610, THE FOUNDRY, Cleveland.

SUPERINTENDENT OR GENERAL foreman desires connection with foundry making high grade semi-steel or gray iron castings. Practical molder; McLain graduate. At present employed; references. Address Box 609, THE FOUNDRY, Cleveland.

SUPERINTENDENT OF MALLEABLE open for a position. Am up-to-date in latest methods. Can handle all branches successfully. Address Box 568, THE FOUNDRY, Cleveland.

MALLEABLE FOREMAN WILL BE open for position January 1. Can get results at lowest cost. Can also handle core room. Address Box 569, THE FOUNDRY, Cleveland.

CORE ROOM FOREMAN SEEKS A PERMANENT position, where demonstration of his ability will earn him a living wage. Fifteen years experience in foundry work. Address Box 612, THE FOUNDRY, Cleveland.

FOUNDRY OWNERS ATTENTION!

WHEN IN NEED OF UP-TO-DATE FOUNDRY FOREMEN OR SUPERINTENDENTS, WRITE US DIRECT. ALL McLAIN MEN HAVE POCKET DIPLOMAS OR ALUMNI BUTTONS — ASK TO SEE THEM.

McLAIN'S SYSTEM, INC.,
803 GOLDSMITH, BLDG.,
MILWAUKEE, WIS.

FACTORY SUPERINTENDENT:—EXperienced executive, 45 years of age, in perfect health, reliable and energetic; 25 years practical experience in designing, drafting, machine work, drop forging, light stamping, woodworking, patternmaking, machine molding and cupola practice. Can refer to past employers. Address Box 564, THE FOUNDRY, Cleveland.

PRACTICAL BRASS SUPERINTENDENT desires position, 23 years experience in brass foundry practice. Have efficiency views, understand metals. Can handle help. Address Box 834, THE FOUNDRY, Cleveland.

SUPERINTENDENT OR FOREMAN OF brass foundry, wide experience in the production of bearing metal castings and the handling of electric, oil fired and crucible furnaces. Address Box 571, THE FOUNDRY, Cleveland.

WANTED:—A POSITION AS STEEL foundry foreman; 25 years experience on light and heavy castings; expert on oil field castings. My cores clean out easily and facing needs no nailing. Address Box 584, THE FOUNDRY Cleveland.

ELECTRIC STEEL METALLURGIST:—25 years old; married; college education; 16 months practical experience in metallurgical work in electric steel foundry; now employed, but desires change; available on short notice. Best of references; inquiries solicited. Address Box 594, THE FOUNDRY, Cleveland.

Positions Wanted

POSITION WANTED AS GENERAL foundry foreman or assistant; 30 years experience, small and large gray iron castings. General foreman for 18 years. Can mix by analysis and give references. Address Box 603, THE FOUNDRY, Cleveland.

PATTERN SUPERINTENDENT OR foreman desires change; eleven years experience as wood patternmaker and three years as executive; gray iron or malleable. Thorough experience in stripper and match plate work on medium and light work. Reliable and good handler of men. Address Box 611, THE FOUNDRY, Cleveland.

ASSISTANT TO MANAGER OR SUPERintendent. Young man, 29, single. Experience in plant operation, office work as purchasing, costs, time keeping and laboratory work. Graduate chemist, also completed training in business administration and accounting. Address Box 593, THE FOUNDRY, Cleveland.

POSITION AS FOUNDRY FOREMAN by McLain graduate. Stove, furnace, light or medium, gray iron or semi-steel castings. Machine experience; good rigger for production. Address Box 591, THE FOUNDRY, Cleveland.

FOUNDRY SALESMAN CALLING ON the trade wants gray iron connection, Metropolitan district. Permanent office in New York City. Address Box 615, THE FOUNDRY, 220 Broadway, New York, N. Y.

TWENTY-TWO YEARS EXPERIENCE in foundry practice in all departments of gray iron, malleable and brass qualify me for responsible position with reputable business concern requiring man who can produce results. Salary incidental to character of opportunity. Address Box 246, THE FOUNDRY, Cleveland.

POSITION WANTED BY AN EXPERIenced foundry foreman, 28 years general foundry practice. McLain System graduate. Chicago district or vicinity preferred. Address Box 574, THE FOUNDRY, Cleveland.

HERE I AM:—A VIGOROUS MAN IN prime of life, with a broad foundry knowledge and successful experience, second to none, open for engagement. The bigger and more strenuous the proposition, the better I like it, and the more successful I expect to be. Highest production, minimum costs, improved methods and morale accompany me. Reliable. Address Box 553, THE FOUNDRY, Cleveland.

A-1 MECHANIC; 20 YEARS EXPERIence on light and medium gray iron castings; 4 years as foreman; cupola experience and McLain System; mixing iron and semi-steel; best of reference. Address Box 583, THE FOUNDRY, Cleveland.

WORKS MANAGER FOR JOBBING steel foundry; 15 years experience electric and open hearth. Address Box 606, THE FOUNDRY, Cleveland.

UNLOAD SHOP WORRIES
on this capable superintendent

Eleven years in gray iron, semi-steel, malleable and brass foundries. Specialized in light test work in gray iron and semi-steel. Mix and melt by analysis. Competent handler of men. Address Box 544, THE FOUNDRY, Cleveland.

Positions Wanted

METALLURGICAL ENGINEER WITH 8 years experience in modern, malleable, gray iron and steel foundries, desires change. Experience covers all phases of the foundry business, capable executive. What have you to offer? Address Box 597, THE FOUNDRY, Cleveland.

POSITION WANTED IN THE PITTSburgh district by young man with wide experience in coremaking and sand mixes. Have technical experience; also experienced in accounting and work of statistical nature. Can furnish best of references. What have you to offer? Address Box 598, THE FOUNDRY, Cleveland.

POSITION WANTED BY FIRST CLASS wood pattern maker. Fifteen years experience; two years bench molding; light, heavy, large or small work; anywhere, southwest preferred. Can take charge or traveling position where a knowledge of pattern shop and foundry practice is essential. Address Box 618, THE FOUNDRY, Cleveland.

STEEL FOUNDRY SUPERINTENDENT is looking to make change; 9 years experience as superintendent; 4 years as foreman molder and 9 years as apprentice and molder. Married and good handler of men. Can get cooperation and turn out a high grade casting. Address Box 607, THE FOUNDRY, Cleveland.

I WANT A BETTER JOB! FOR TWENty-seven years I have made intricate iron, brass and aluminum castings; twenty years as foreman and superintendent. Make me an offer. Address Box 410, THE FOUNDRY, Cleveland.

POSITION AS FOUNDRY SUPERINtendent or foreman. Twenty-six years on light, medium, heavy castings; mixing, melting and core work in general line foundry practice. McLain graduate, age 40. Address Box 520, THE FOUNDRY, Cleveland.

Business Opportunities

PATENT FOR SALE

RERAILER or Electric car, steel casting. Successfully tried out. 20,000 companies need this device. J. A. Sherman, Inventor, 1517 16th NE, Canton, Ohio.

FOUNDRY MANAGER WITH CONSIDerable sales experience, both steel and gray iron, with $10,000 capital, desires association with established and financially sound concern. Address Box 556, THE FOUNDRY, Cleveland.

A LEADING CANADIAN SHIPPER OF foundry sands would like to represent and act as sales agent for any American manufacturers of foundry supplies or equipment. Address Box 581, THE FOUNDRY, Cleveland.

A MICHIGAN REPRESENTATIVE would like to obtain reputable Foundry producing high grade gray iron and semi-steel castings, preferable, Northern part of Ohio. A production Foundry can obtain very desirable work. Address Box 586, THE FOUNDRY, Cleveland.

Foundries Wanted, For Sale or Lease

FOR SALE:—BRASS FOUNDRY, DOING good business. Complete equipment. Good reason for selling. Address Box 913, THE FOUNDRY, Cleveland.

FOR SALE OR LEASE:—TWO CUPOLA furnace, five ton capacity. Full machine shop equipment, including lathes, drill presses, etc. Private switch. Main building 118′ x 139′ 6″; several small outbuildings; entire site 290′ x 265′. Howe Safety Appliance Company, Trustees for Bond Holders, c/o Morriss Realty Company, Granite City, Ill.

FACTORY BUILDING AND SITE FOR sale; facilities for railroad siding. Covers approximately four acres with 10,000 square feet floor space. Brick building. About one hour from New York, near town 25,000. Address Box 608, THE FOUNDRY, Cleveland.

SMALL IRON FOUNDRY IN SOUTH Jersey; new equipment, including stock, delivery truck, coke, scrap, garage, etc. Will sacrifice on account of sickness. Address Box 517, THE FOUNDRY, Cleveland.

For Sale

FOR SALE

2—18 x 18 x 5 Tabor Power Portable Combination Shockless, Jarring, Rollover and Pattern Drawing Molding Machines—Price $500 each.

1—Osborne Plain Power Jolt and Squeezer Molding Machine, Like new—Price $200.00.

Hempfield Foundries Co.,
Greensburg, Pa.

1—Only No. 406 Osborn Direct Draw Roll Over Jolt Molding Machine Complete, 72" x 42" table, Serial 13380-A

1—Only No. 103 Osborn Plain Jolt Molding Machine Complete, 54" x 66" table, Serial 3196-A

These machines have had very little use and are in good condition. Price for both machines, $1,000.00, f. o. b. plant, Kanawha Manufacturing Company, Charleston, W. Va.

NEW OSBORN MOLDING MACHINES

2—No. 406 Roll Over Jolt.
1—No. 406-S Jolt Stripper.
Never used—Very low prices

H. F. WARDWELL
1300 E. 92nd St., Chicago, Ill.

FOR SALE:—TWO G. E. COMPRESSORS, both 60 cycle 3 phase. One has 10 HP capacity for operating on 550 volts; the other, 20 HP capacity for operating on 220 volts. Both nearly new, in good running condition. Will sell very reasonably. Write S. W. Pierce, Purchasing Agent, The Lamson Company, Inc., Syracuse, N. Y.

FOR SALE

1—30" x 72" Tumbling Barrel.
7—1 and 2 Ton hand operated cranes 32' span.
1—1 ton Rennefelt Electric Furnace transformer 2300V/130V.

T. B. MacCabe,
2641 Christian Street, Philadelphia, Pa.
Long Distance Telephone Locust 3577.

FOR SALE
USED FOUNDRY and PATTERN SHOP EQUIPMENT

Two entire iron foundry outfits Consisting of Cupolas, Air Compressors, Auto Sand Cutters, Tumbling Mills, Pneumatic Hoists, Motors, Molding Machines, Sand Mixers, Grinders, Band Saws, Jointers, etc., etc. All in good working condition. If the machine or equipment you require is not listed above, write us stating your requirements.

THE BUCKEYE PRODUCTS CO.,
919-929 W. 5th St. Cincinnati, Ohio.

FOR SALE

One (1) SLY 60" diameter by 72" Single Round Tumbling Mill, complete with 48" x 11" tight and loose pulleys. Cylinder practically new. Size of door in cylinder 36" x 64". Condition good. Attractive price for quick disposal.

THE NILES TOOL WORKS COMPANY,
Hamilton, Ohio.

FOR SALE

3—Five ton Pawling & Harnischfeger traveling cranes.
1—Twenty-five ton Cleveland crane.

MOTORS AND DYNAMOS—ALL SIZES AND KINDS
GEORGE SACHSENMAIER CO.
936 N. Third St., Philadelphia, Pa.

FOR SALE:—ONE DERRICK, BUCKET operating, manufactured by the American Hoist and Derrick Company, capacity 5 to 10 tons complete. Kings County Iron Foundry, Gardner Ave. & Meserole St., Brooklyn, N. Y.

Wanted

FOR EXPANSION PURPOSES

We will consider any article of foundry equipment that is in good operating condition. Send full details and price. Address Box 296, THE FOUNDRY, Cleveland.

WANTED:—ONE NO. 94 MONARCH Simplex Furnace. State price, condition and equipment included. Address The Maytag Company, Newton, Iowa.

For Sale

FOR SALE

10—20 Ton Core Oven Trucks.
10—2 Ton Core Oven Trucks.
1—No. 1 Simpson Mixer.
1—Each AO, No. 2, No. 4 Standard Core Sand Mixers.
1—60" x 60" International Plain Jolt Molding Machine.

CUPOLAS

1—Each No. 3, No. 5, No. 6, No. 7 and No. 9.

MOLDING MACHINES

7—Grimes Model H-512 cap. 650 pound, 12" draw.
4—Grimes Model K-814, cap. 1500 pound, 14" draw.
3—Grimes Model A-108, 8" Draw (Hand)
2—Grimes Model A-112, 12" draw (Hand)
2—Grimes Model C-214, 14" Draw (Hand)
6—Davenport Power Squeezer, 32" between uprights.
1—Osborn Little Wonder 45-P
1—Osborn Little Wonder 47-P
1—Osborne 402-406
1—Nichols Jolt Squeezer.

BLOWERS

1—Green 6-B DC to 50 H. P. 3-60-220 V. motor.
1—Each G. E. Centrifugal Type 2000' cap., 2500' and 6100'.
Roots No. 3, No. 4, No. 5, No. 6, No. 6½ and No. 7.
Connersville 6', 8', 63'—1 Piqua 35'.

CRANES

1—20 Ton, 4 motor, 34' span, 220 V. D. C.
1—25 Ton, 4 motor, 80' span, 3-60-220 V.

HOISTS

1—½Ton Detroit 3-60-220 V.
1—1 Ton Sprague 3-60-220 V.
1—2 Ton Euclid 220 V. D. C. 2 Motor.
1—? Ton Sprague 3-60-220 V. 2 Motor.
1—3 Ton Shepard, 3-60-220 V.
1—5 Ton P. & H. 220 V. D. C. 2 Motor.

SCULLY-JONES & COMPANY
Chicago, Ill.

The Foundry Equipment Listed Below Can Be Inspected in Our Own Warehouse

Monarch Simplex Furnace No. 93.
Dings Magnetic Separator, Type O-2, Style-C, with 220 volt D.C. motor, capacity 150 cu. ft. per hour.
Whiting Tumbling Barrel, 36" x 48", stave type.
Standard Sand Mixer, 23" x 72", mixing trough.
42" Schwartz Furnace, capacity 500 to 1000-lb.
Sprue Cutter, No. 147 Toledo, capacity 3" Brass Gates, weight 22,500-lb.

MOLDING MACHINES

Arcade, rollover and drop, hand.
(2) Herman, plain jarring and stripping, 30" x 45".
(2) Mumford, power, jolt, squeeze, draw.
Osborne, Nos. 52, 75-J and 102.
(2) Tabor, power, jolt and squeeze, 10" cylinder, 32" between rods.

Partial list only.
Tell us what you want.
Offer us your surplus equipment

F. H. CRAWFORD & COMPANY
299 Broadway, New York City
Eastern Sales Agents for Hausfeld Furnaces, Schwartz Furnaces, Etc.

FOR SALE:—FOUR SETS DRAWER type core oven equipment, including five drawers per set complete, less brick. Will take care of cores 8" high. Perfect condition. Real bargain. Write for full particulars. The Frost Naus Company, Minneapolis, Minn.

FOR SALE

6—No. 60 Robinson Hot Air Pipeless Furnaces, heating capacity 50,000 lbs to 60,000 lbs. cu. ft.

SCULLY-JONES & COMPANY,
3609 So. Ashland Ave.,
Chicago.

CUPOLA, COMBUSTION AND EXHAUST BLOWERS

Largest stock for all purposes. Foundry equipment of all kinds. Send us your inquiries for your needs in Machinery and Foundry Equipment of all kinds. Centrally located for quick service. The Clifton-Pratt Co., Cincinnati, O.

For Sale

HAND RAM
STRIPPING PLATE MACHINES

1—9" x 12" x 4¾" draw, Type D, Pridmore.
1—14" x 14" x 4¾" draw, Type D, Pridmore.
3—10" x 16" x 4¾" draw, Type D, Pridmore.
1—18" x 18" x 4¾" draw, Type D, Pridmore.
4—22" Round 4¾" draw, Type B, Pridmore.
1—40" Round 6" draw, Type K, Pridmore.
2—12" x 13½" x 8" draw, Type J, Pridmore.
1—24" x 48" x 10" draw, Type Y, International.

HAND RAM ROLLOVER MACHINES

1—14" x 8" draw, Type R, International.
2—14" x 4" Draw Core Machines, Bench Type, International.
1—14" x 8" draw, Type H, Pridmore.
1—No. 45P Osborn "Little Wonder," Osborn.
2—16" x 14" x 5" draw, Type H, Pridmore.
1—18" x 8" draw, Type R, International.
2—24" x 8" draw, Type R, International.
1—24" x 22" x 8" Draw Hand Ram Power Rollover, Type HP, Pridmore.
1—29" x 24" x 12" Draw Hand Ram Power Rollover Type HP. Pridmore.
1—24" x 6" draw, Tabor.

SQUEEZERS—HAND AND POWER

2—Berkshire Hand Squeezer with pattern draw, Type E, Berkshire.
3—10" Air Squeezers, Sand Straddler Type, Type Y, Pridmore.
1—10" Stationary Power Squeezer, Tabor.
11—No. 3 Modern Machine, Arcade.
1—No. 34 Modern Machine for piston drags, Arcade.
1—No. 11 Modern Machine, Arcade.
2—Adams Hand Squeezers, Adams.

JOLT MACHINES
PLAIN AND COMBINATION

2—20" x 20" Jolt Strippers, Davenport.
1—24" x 24" x 10" draw, Type TJ, International.
1—36" x 72" x 12" Draw Electric Jolt, Air Stripper, Pridmore.
3—No. 80 Jolt, Squeeze Strippers, Osborn.
3—No. 81 Jolt Squeeze Strippers, Osborn.
1—Special Jolt Stripper for Piston Copes, Arcade.

MISCELLANEOUS EQUIPMENT

1—Portable Core Oven, Hill & Griffith.
2—Geared Ladles 1½ Ton and 3 Ton Capacity, Whiting.
1—No. 9 Cupola with Charging Device, Whiting.

Our Re-Manufactured machines are guaranteed to be in as good working condition as new equipment. If the machine you need is not listed above, write us, as this list contains only equipment ready for shipment.

Note—We build Stripping Plate and Rollover Machines. Standard sizes carried in stock, special sizes built to order.

CHAMPION FOUNDRY & MACHINE CO.,
3018 West 21st Place,
Chicago, Ill.

BARGAINS!

1—Used B. F. Sturtevant No. 8 bottom discharge, double belt drive blower, with 6" x 9" diameter pulleys on each side of blower, together with counter shaft for same .....$ 75.00
1—Used 30" General Electric Magnetic Chuck, 115 Volts, revolving type, worm driven, direct Cur.....$150.00
1—Used Brown 2000 degree Fahrenheit Electric Pyrometer, with points for 8 units .....$ 65.00
1—Used Cincinnati Time Clock with Card Racks .....$ 60.00
1—New Midwest Utilitor with 30" Lawn Mower attachment $150.00

Wm. E. Dee Company,
Harvey, Illinois.

60" DOELCAM ROTARY SAND BLAST machine, oscillating nozzles, bucket type sand elevator, storage tank and sand separator. Used six weeks, equal to new. Photograph on application to Simmons Machine Tool Corporation, Troy Road, Albany, N. Y.

FOR SALE:—ONE NEW NO. 5 WILbraham-Greene Blower with cast iron base plate arranged for motor drive. One second-hand No. 5-B Wilbraham-Greene Blower with cast iron base plate arranged for motor drive. In first-class condition. One second-hand No. 4 Whiting Cupola without brick lining, spark arrester, or roof hood. Franklin Machine Co., Providence, R. I.

TWO NO. 403 OSBORN DIRECT DRAW Roll-Over Jolt Moulding Machines, used for two thousand moulds only on account of changing model. Offer price. Nash Motors Co., Kenosha, Wis.

Index to Advertisements

A

Adams Co. 23, 33
Ajax Metal Co. 3
American Appraisal Co. 57
American Boron Products Co., Inc. 82
American Engineering Co. 61
American Foundry Equipment Co. .. 25, 90
Arcade Manufacturing Co. 32
Armington Engineering Co. 61
Ashland Brass Foundry 67

B

Babcock Testing Laboratory 84
Bacharach Industrial Instrument Co. 78
Bartlett, C. O., & Snow Co. 35
Beardsley & Piper Co. 12, 13
Beling-Bush Co., Inc. 65
Berkshire Mfg. Co. 74
Bethlehem Steel Co. 47
Borne Scrymser Co. 71
British Aluminium Co., Ltd. 82
Brosius, Edgar E. 61
Browne, deCourcy, Inc. 82
Buckeye Sand Co. 67

C

Cape May Sand Co. 69
Carborundum Co. 46
Chain Products Co. 67
Champion Foundry & Machine Co. 87
Chase, Frank D., Inc. 17
Chase Foundry & Manufacturing Co. 63
Chemical Treatment Co. 79
Chesapeake Iron Works 61
Clark, Chas. J., Blast Meter Co. 78
Cleveland Armature Works, Inc. 74
Cleveland Crane & Engineering Co. .. 27, 28
Cleveland Nickel Works 76
Cleveland Pneumatic Tool Co. 75
Cleveland Steel Tool Co. 67
Clifton-Pratt Co. 87
Corn Products Refining Co. 14
Crawford, F. H., & Co. 87
Cumberland Sand Co. 67
Curtis Pneumatic Machinery Co. 63

D

Davenport Machine & Foundry Co. 74
Detroit Electric Furnace Co. 45
Dings Magnetic Separator Co. 37
Dixon, Joseph, Crucible Co. 71
Dock & Mill Co. 67

E

Electric Furnace Co. 78
Electro Metallurgical Sales Corp. 83
Elwell-Parker Electric Co. 63
Ernst & Ernst 59

F

Federal Malleable Co. 34
Foundry Equipment Co. 41
Foundry Manganese Co. 82
Foundry Supplies Mfg. Co. 73
Fowler & Union Horse Nail Co. 72
Franklin Core Rod & Gagger Co. 72
Fuller Engineering Co. 84

G

Gautier, J. H., & Co. 78
General Furnace Co. 78
Globe Steel Abrasive Co. 76
Grimes Molding Machine Co. 74
Grindle Fuel Equipment Co. 79

H

Hanna, M. A., Co. 83
Hanna Engineering Works 61, 74
Harrison Supply Co. 76
Hauck Manufacturing Co. 79
Henderson Brothers Co. 76
Hercules Powder Co. 18
Hergi Mfg. Co. 67
Herman Pneumatic Machine Co. 26
Hill & Griffith Co. 16
Hillman Coal & Coke Co. 83
Hillside Fluor Spar Mines 82
Hoevel Manufacturing Corp. 77
Holcroft & Co. 84
Hyatt Roller Bearing Co. 53

I

Imperial Brass Mfg. Co. 79
Independent Pneumatic Tool Co. 74
Industrial Works 63
Ingersoll-Rand Co. 80
International Nickel Co. 48
International Oxygen Co. 79

J

Jones Sand Co. 69

K

Kawin, Charles C., Co. 84
Keener Sand & Clay Co. 69
Kellogg, Spencer, & Sons, Inc. 8, 9
Knefler-Bates Manufacturing Co. 20
Knickerbocker Co. 65
Koven, L. O., & Brother, Inc. 77

L

Lava Crucible Co. of Pittsburgh 78
Leavitt, C. W., & Company 83
Link-Belt Co. 81

M

Macleod Co. 65
Magnetic Manufacturing Co. 72
Malleable Iron Fittings Co. 39
Metal & Thermit Corporation 83
Mifflin Chemical Corporation 71
Milwaukee Electric Crane & Mfg. Co., Inc. 61
Moline Iron Works 30
Motorbloc Corporation 61

N

National Engineering Co. 29
New Haven Sand Blast Co. 77
New Jersey Zinc Co. 50
Northern Engineering Works 61
Norton Company 75

O

Oliver Machinery Co. 67
Oxweld Acetylene Co. ..... Inside Front Cover

P

Pangborn Corp. 10, 11
Pawling & Harnischfeger Co. 51
Paxson, J. W., Co. .....19, Back Cover
Penn Foundry & Mfg. Co. 63
Pennsylvania Pump & Compressor Co. 74
Pettinos, George F. 22
Philadelphia Chaplet & Mfg. Co. 72
Phillips & McLaren Co. 72
Pilling & Co., Inc. 83
Pittsburgh Electric Furnace Corporation . 78
Portage Silica Co. 69

R

Randall Tramrail Co. 63
Rogers, Brown & Co. 83
Rohmer, Gabriel E. 84
Roots, P. H. & F. M., Co. 44
Ross-Tacony Crucible Co. 78
Royersford Foundry & Machine Co., Inc. . 77

S

Safety Equipment Service Co. 73
Scully-Jones & Co. 87
Shepard Electric Crane & Hoist Co. 63
Shore Instrument & Mfg. Co., Inc. 84
Skinner Bros. Manufacturing Co., Inc. 59
Sly, W. W., Mfg. Co. 15
Smith, Werner G., Co. 4, 5
Specialty Mfg. Co. 63
Spencer Turbine Co. 42
Standard Alloys Co. 84
Standard Equipment Co. 77
Standard Radial Blast Corp. 76
Standard Sand & Machine Co. 31
Standard Silica Co. 24
Steel Shot & Grit Co., Inc. 76
Sterling Wheelbarrow Co. ..... Front Cover
Stevens, Frederic B., Inc. .. Inside Back Cover
Strand, N. A., & Co. 75
Sturtevant, B. F., Co. 21
Sullivan Machinery Co. 38
Superior Sand Co. 67
Swartwout Co. 43
Swindell, William, & Brothers 78

T

Tilghman-Brooksbank Sand Blast Co. 77
Titanium Alloy Mfg. Co. 49
Truscon Steel Co. 6, 7

U

United Compound Co. 72
United States Chaplet & Supply Co. 72
United States Graphite Co. 72
United States Silica Co. 36

V

Vibrating Machinery Co. 73

W

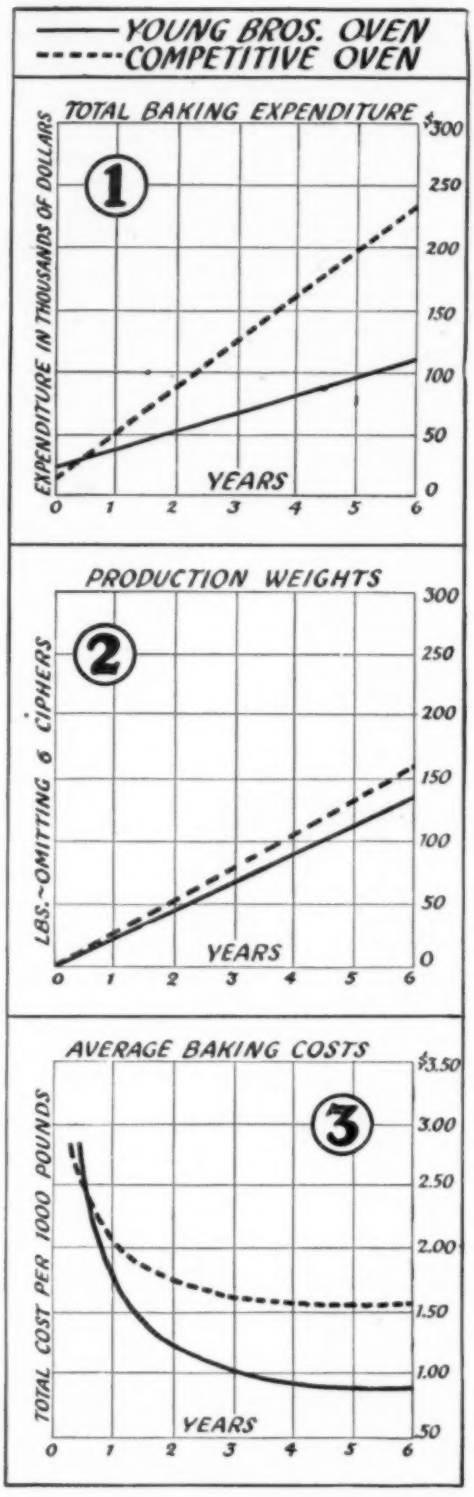
Wardwell, H. F. 87
Wellman Products Co. 67
Westinghouse Traction Brake Co. 74
Whitehead Brothers Co. 69
Whiting Corp. 54, 55
Wiggins, John B., Co. 65
Williams, G. H., Co. 63
Wilson Welder & Metals Co., Inc. 79

Y

Young Brothers Co. 89

"Where-to-Buy," page 56 Classified Advertisers, pages 85-87 Table of Contents, page 992

Your Baking Cost Per Unit —*Let Us Help You Lower It*



Based on your unit of production, is your baking cost as low as it should be? How do you figure your cost—on your total baking investment, representing cost of oven, fuel, interest and depreciation—or have you merely considered the first cost of your oven?

Figures in many industries, using ovens for many different purposes, show that Young Brothers Industrial Ovens are constantly delivering completed work at a lower cost per unit than other oven equipment.

Recently one of the largest automobile manufacturers in the country conducted a competitive test between a Young Brothers Continuous Conveyor Oven and a slightly larger competitive oven. Results of the test are shown by the graphs on this page computed for a period of six years.

The total baking investment represents first cost of the oven, plus interest, repairs and depreciation, and heating costs. In spite of the higher first cost of the Young Brothers oven, the total investment with it is less at the end of six months, and decreases steadily after that date.

In total production weight, the Young Brothers oven is slightly behind its larger competitor.

Most important of all, however, is the average cost per unit of production. Here, as is shown by the third chart, the Young Brothers equipment consistently leads. This figure represents the total baking expenditure up to any time divided by the total production weight up to the same time—and shows that the Young Brothers oven is producing finished work at little more than half the cost per unit of the other oven.

Young Brothers Industrial Ovens will give you similar results in the solution of *your* oven problems and in lowering *your* baking costs. Let us consult with you regarding your oven equipment. We will gladly place at your disposal the experience of our corps of engineers—men who have participated in most of the large oven installations throughout the entire country.

Young Brothers Company

506 Exchange Bldg.
Windsor, Ontario

6508 Mack Avenue
Detroit, Michigan

District Sales Offices:

52 Vanderbilt Ave., New York
730 Engineers Bldg., Cleveland
611 Granite Bldg., St. Louis
20 E. Jackson Blvd., Chicago
807 San Fernando Bldg., Los Angeles
419 Call Bldg., San Francisco

YOUNG BROS. CO. OVENS — OUR BOLTLESS JOINT — DETROIT MICH.

Makers of ovens for core and mold baking, low temperature heat treating, drying, japanning and enameling, electrical apparatus baking and all other processes requiring 900 degrees or less of heat. Our ovens are adapted to use any method of heating.

INDUSTRIAL OVENS

Users Series—
No. 18

Typewriter Castings made in machine-tempered sand.

Wouldn't Christopher Latham Sholes, who built the first practical typewriting machine, in 1873, thrill with pride to see the present perfection and world-wide use of the product of his fertile brain—the modern Remington?

The Remington Foundry was one of the first to adopt mechanical sand-cutting. For many years the cast parts of Remington Typewriters have been molded in sand tempered daily by American Sand-Cutting Machines.

Perhaps your work requires castings of similar fine quality, accuracy, and finish. American Sand-Cutting Machines eliminate some of the costly uncertainties of foundry practice. Mechanically tempered sand speeds up molding production, improves the finish, reduces discount, and saves a tremendous amount of labor.

We believe our new catalog of American Sand-Cutting Machines would interest you. Sent upon request.

The American Foundry Equipment Co.

368 Madison Avenue, New York, N. Y.

Direct representatives in principal foundry centers

AMERICAN FOUNDRY EQUIPMENT